CHALMERS

Public procurers as promoters of innovation

Master of Science Thesis in the Master Degree Programme, Management and Economics of Innovation

ERIK ANDRÉ
BAHAR SHAYEGH HARSINI

Department of Technology Management and Economics
Division of Innovation Engineering and Management
CHALMERS UNIVERSITY OF TECHNOLOGY
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ERIK ANDRÉ
BAHAR SHAYEGH HARSINI

Tutor, Chalmers: Sara Fallahi
Examiner, Chalmers: Magnus Holmén
Tutor, SP: Fredric Norefjäll

Department of Technology Management and Economics
Division of Innovation Engineering and Management
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Department of Technology Management and Economics
Division of Innovation Engineering and Management
Chalmers University of Technology
SE-412 96 Göteborg, Sweden
Telephone: + 46 (0)31-772 1000

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Abstract

Innovation has been a hot topic of research over the years and is by many authors acknowledged to be a significant driver of economic growth. From an innovation system perspective, the roles and influences of the different actors in the system are fundamental to create an infrastructure that is innovation friendly. A society that is innovation friendly is significant in order to increase the national competitiveness and economic wealth.

Public procurers are one type of actor in the innovation system. According to literature, public procurement is a powerful tool, which can be used to promote innovation. However, in practice, there are few examples of successful public procurement of innovation. The purpose of this thesis is therefore to provide an understanding on why there have been so few examples of successful procurements of innovation by public agencies in practice.

A multiple-case study was performed with the use of unstructured interviews with SP (Technical research institute of Sweden AB), semi-structured interviews with both public procurers and suppliers, and finally by looking at secondary data containing cases of procurement of innovation.

The findings are that the primary reason for why public procurers do not act as promoters of innovation is not lack of knowledge on innovation-friendly ways to specify the requirement specifications such as FRS (functional requirement specifications), which was believed to be one potential cause of the problem. In fact, most of the public procurers interviewed knew about FRS, but did not use it since it was perceived to be complex and that they [the public procurers] do not see themselves as having the role as promoters of innovation.

The conclusion is that all comes down to the importance of aligning the interests of both suppliers, procurers and the society which are all parts of the innovation system; and that important lessons of how to do this can be learned from cases of successful procurement of innovation, some of them covered in this report.

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Erik André & Bahar Shayegh Harsini
Department of Technology Management and Economics
Division of Innovation Engineering and Management
Chalmers University of Technology

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1 - Introduction

The introduction gives the underlying structure of the conducted research. It includes a background of the area that has been investigated. The purpose of the thesis is presented with corresponding research questions. Following this, the disposition of the thesis is presented and this chapter one is finalized with delimitations.

1.1 Background

Innovations have laid the foundation of what is seen in the society today, an important source of economic wealth which has great importance for the development of the society, in terms of technology and culture at large (Abernathy & Clark, 1985, Porter, 1990, Granstrand, 1999). Many definitions of innovations exist; Granstrand (1999) defines innovation as something novel to the world that has found a useful and commercially viable application. Two distinctions of innovations are being made, continuous and discontinuous innovations. While continuous innovations are incremental improvements which are vital to protect the company's revenues through growing market share, discontinuous innovations include radical innovations that give room for new markets and industries to emerge, transform or disappear (Kaplan, 1999).

To ensure economic and social wealth in the long run, stimulating innovation is an important task for the society. There are many potential ways of stimulating innovation, for example innovation prizes, regulations such as IPR's and grants to innovative companies. One potential way to do this that is of particular interest for SP, which this research intends to contribute to, is public procurement as a government instrument to promote innovations. The importance of this instrument is also stressed by many authors (Rothwell, 1984, Edler & Georghiou, 2007, Bröchner, 2009, Rolfstam, 2009). Rothwell (1984) was among the first to bring up the question and emphasize how public procurement activities can stimulate supplier innovations. Firstly, he argues that public procurement can promote and create new markets as a direct impact of the purchase. The level of entry and switching costs is dependent on the radicalness of the innovation. The more radical an innovation is, the harder it is to increase the diffusion of it, and a strong initial demand in the early phases can have effects that accelerate the diffusion of the innovation (Edler & Georghiou, 2007). Secondly, Rothwell (1984) argues that if the government can communicate their requirements in functional or performance terms they would allow development of innovations instead of locking it into already existing standards. Thirdly, the government procurers can be used as a testing ground where

prototypes can be improved, which will reduce the market risk for innovators. Kaplan (1999) emphasizes that it is very difficult to make an estimation of the market size and *"how the innovation will be received"* (Kaplan, 1999, p.20). Projecting this risk to the government procurers might create incentives to not only increase the amount of innovations within a society but also to increase the level of radicalness of innovations, which is significant to sustain substantial growth over the long horizon (Kaplan, 1999).

Furthermore, these findings of Rothwell (1984) are interesting to compare with the actions taken in reality. The reason for this is that a very large amount of money, estimated to be 56 billion EUR (Fryksdahl & de Jounge, 2011), and 1500 billion EUR (VINNOVA, 2009) for the Europe Union; is spent every year on public procurement. How the procurement decisions of public procurers influences the market, is therefore of great interest to study.

Moreover, innovations cannot be seen as a single isolated event, but rather a result of a system, an innovation system. Different actors and institutions form a complex system, in which innovations evolves. The innovation systems concept emphasizes that the creation, diffusion and use of knowledge among actors is core to an innovation process. Innovation systems can be defined in a number of different ways and levels; national, regional, sectoral or technological (Carlsson et al., 2002). The focus in this report will be at the national innovation systems level. The dynamics of innovation systems comes from the interaction between its actors. For an industry to be able to adapt to its environment the response towards changes must be rapid. Again here we can see the importance of communication among its actors, not only to foster innovations but also to be able to create an innovation friendly infrastructure.

1.2. Purpose

Innovation is a field that has been studied by many authors over a long period of time. Public procurement has also been studied. The relation between these two fields of studies, public procurement of innovation (PPI), has been studied by e.g. Bröchner (2009), Edler & Georghiou (2007), Rolfstam (2009) and Rothwell (1984). These authors' findings show that public procurers have a potential role as promoters of innovation. However, there is only a very limited set of examples where their explanations and theories have worked in practice. This brings out the following question; why is evidence for successful public procurement of innovation so

infrequent? There is a gap between what the mentioned research theories suggest, and what is happening in reality. Understanding this gap is essential as the first step in trying to mitigate this problem. One explanation for this could be that public procurers are not aware of their role as promoters of innovation, and that public procurers and suppliers have different perspectives on the subject being another one. As innovation is an important source of economic wealth, which has great importance on the development of the society (OECD & Eurostat, 2005, Rosenberg, 2004), promoting it is something that should be at the very interest of the society. The aim of this report is to explore what the gap between public procurers' and suppliers' perspectives on the subject is, and if the public procurers are unaware of their role as promoters of innovation. To do this, a thorough understanding on the process of public procurement is warranted. This entails an investigation of how the procurement process looks like in theory as well as in practice. Furthermore, as with any setting where procurement is conducted, the interests and perspectives of the involved parties may differ. This difference in interests, especially in relation to innovation, may inhibit the process of generating and diffusing innovations. Therefore, an investigation with the purpose of understanding this difference, if any, is justified.

In order to collect both perspectives, public procurement in relation to innovation will be looked at through two separate lenses. One being the role of public procurers as customers, and the other through a more holistic innovation system perspective. The innovation system reaches beyond the notion that procurement is a single isolated event and also incorporates the flow of information, such as needs, offerings. The role of public procurers as customers will be investigated by classifying them based on the technology diffusion curve, where they can take on the role as innovator, early adopter, early majority, late majority or even laggards. Furthermore, the possibility of taking the role of a lead user will be investigated. A lead user will not only be an early customer or promoter of innovation, but also helps to develop the innovation itself.

All of the above-mentioned aspects are particularly interesting to the research institute SP, which this report aims to contribute to, as they in cooperation with the Ecopol project intents to accelerate eco-innovation policies as an instrument to promote eco-innovations across Europe.

1.3. Research questions

In the purpose of this report, it was stated that one explanation for why there are little evidence on the role of public procurers as promoters of innovation, was that public procurers are generally unaware of their role as promoters of innovation, and another that public procurers and suppliers have different perspectives on the subject. In order to investigate this, a set of questions has been created. These questions have furthermore been divided into more specific sub-questions that will be investigated at lower level of aggregation.

The ability to influence technological change through public procurement changes with the stage of maturity of the product and industry. This fact is verified by Rothwell (1984), which identified that the possibility to have the highest impact on the product is in its early phases of development. Thereby, the first set of questions is related to how the current situation for public procurers look like in terms of what customer type they are, both when it comes to classification in the customer diffusion model and also if they have lead user characteristics. Classifying the public procurers as a certain type of customer will give an insight in which stage the procured products and services usually are, which in turn affects the level of influence a public procures can have. There are also other factors influencing the development of innovations simultaneously. Therefore, the second set of questions is related to the innovation system. Sub-questions are towards areas such as functional requirement specification, which is by Rothwell (1984) identified to be one way to facilitate procurement of innovation, communication outside the procurement process and finally also co-development of solutions, which relates to the role of a lead user. The sub-question concerning functional requirement specification brings in the aspects public procurement of innovation from an innovation system perspective, asking for if whether public procurers are using a more innovation friendly method or not as a method to communicate their need to the suppliers. The two later sub-questions also bring in the roles of government agencies and government policies in the procurement process. The role of government policies, Markard and Truffel (2008) argues, regulates and sets incentives to direct the innovations in certain directions and sometimes as an attempt to avoid others. At an aggregated level, the two later sub-questions will give an insight on if and how the policies affects the communication and co-development between suppliers and public procurers, and hereby the level of influence on the development of innovations within the innovation system.

The questions can be summarized as follows:

I. What role do public procurers have as customers towards the promotion of innovation?

I.i - What customer type are public procurers?

I.ii - Do public procurers, and if so how, act as lead user?

II. How does the role of public procurers as promoters of innovation currently look like from an innovation system perspective?

II.i - To what extent is functional requirement specification, as a way of facilitating innovation, known and adopted?

II.ii - How does the awareness, and possibly even use, of communication outside the regulated procurement process look like, from both the perspective of procurers and suppliers?

II.iii - How is co-development of solutions perceived from both the procurers' and suppliers' point of view?

These research questions were compiled based on findings from the discussions with representatives at the company SP, that this research is conducted with. Hereby, the research performed in this report is of great interest to SP, and it has been achieved in close cooperation with them. SP is a Swedish government owned research institute and is currently one of the largest in Sweden. The activities at SP aim to build a strong base of knowledge and capabilities in close cooperation with small and large companies, universities, other research institutes, and international partners. A more thorough description of SP will be presented in section 4.1.

1.4. Disposition

The report is structured as follows. In the second chapter, a literature review section is provided, which covers previous research relevant to this report. Following the literature section, chapter three describes the methodology of this report. The methodology section covers areas such as research design, the methods of obtaining the findings, as well as a section covering research quality, reliability and validity.

After having described the method, chapter four presents the findings whereas an analysis of these findings in connection to the literature review is performed in chapter five. In chapter six, a discussion of the findings and its implications is provided. Chapter seven presents the conclusions made based on the analysis and discussion performed in former chapters and finally, suggestions for further research is covered in chapter eight.

1.5. Delimitations

Although the basic principles of public procurement is similar in the countries of the European Union due to partly shared regulation as will be described in the following section, this report will focus on Sweden and the Swedish market. Therefore the primary data for this report will be collected from Sweden, although there will be some secondary data based on examples from other studies of other European countries.

The exact legal formulation will not be covered in this report as it easily becomes very complex. However, a general overview of the legal framework that affects public procurement, the Law of Public Procurement (Lagen om offentlig upphandling, LOU) will be given in the literature review section.

There are some exceptions when the law of public procurement does not apply, although the procurements are made by authorities otherwise affected by the law of public procurement, such as when the value of the procurement is lower than a certain threshold. These exceptions are not considered in this report, as they are believed to be insignificant to the research questions of this report.

The importance of governmental policy has been identified during the research conducted in this report. How these policies should be formulated and how they would affect the role of public procurers is an aspect that is very interesting to this question but not focused on in this report. This is due to the fact that it is a subject that deserves an entire report of its own and it was not possible to conduct in this report due to time and resource constraints.

2 – Literature review

The literature review presented in this chapter gives together with the empirical results a basis for analysis and discussion. This chapter is divided into five main parts. First a general background of innovation is presented. The second part provides literature related to innovation system. The focus is then shifted to give an overall description of public procurement and its processes. Finalizing this chapter, different types of customers are described. This is important to understand as different types of customers have different roles when it comes to supporting innovation.

The previous research can be divided into five main topic areas. The literature review chapter starts with a general description and definition of innovation. Following this, the definition of different types of innovations, categorized as continuous and discontinuous, is presented. Secondly, literature related to the context of innovations will be covered; the so-called innovation system. The third area of literature contains a general description of what public procurement is and how the process of public procurement looks like. The intersection between innovation and public procurement will be the area where the main focus of this report will be. This area is referred to as public procurement of innovation and will be introduced in the literature review in order to give an overview of what this report will be investigating. Finalizing the literature review chapter, innovation diffusion and the technology adoption curve is described. This leads us to a distinction between different types of customers; innovators, early adopters, early majority, late majority and laggards. After this distinction, the innovators and early adopters are related to lead users and describe their potential roles in helping innovations to cross the so-called chasm between the early adopters and the early majority.

A graphical illustration of the literature review and how the different parts are related is illustrated in *Figure 1* below.

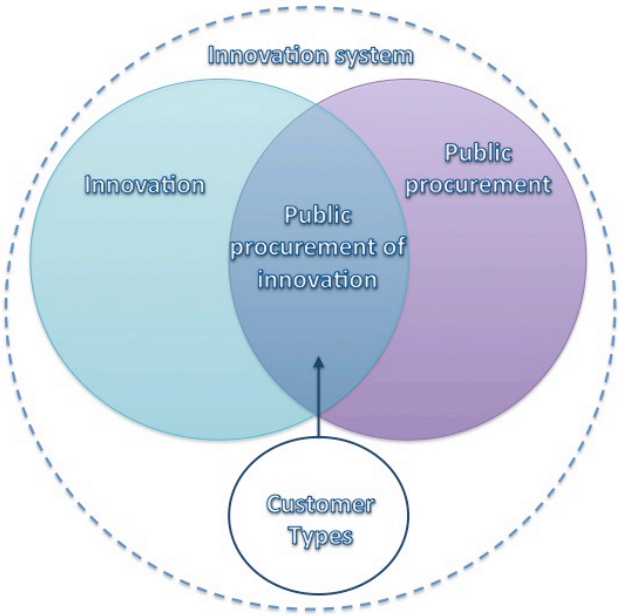

Figure 1 Illustration of the literature review

2.1 Innovation

Innovation has been a frequent field of research for many years. There exist theories on innovations from many different perspectives, each giving interesting and significant insights. In this report, the emphasis will be on the area where innovations and public procurement overlap, as illustrated in *Figure 1* in the previous chapter.

Joseph Schumpeter was among the first to emphasize the process of innovation, and he has been a great source of inspiration for other theories of innovation. Schumpeter identified the innovation process and simplified it into three stages – *invention, innovation* and *diffusion*. The distinction of these three concepts attended to emphasize the role of the entrepreneur throughout the whole process and to put the main focus on more radical innovations. (France, Leitner, Wehrmeyer, 2010, OECD; Freeman, 1991)

An *invention* is defined as a novelty or creation that has not yet become commercially viable. Many times, inventions unfortunately stay as a scientific curiosity and never goes further than the laboratory doors. For an invention to become an innovation it requires success in application. (Granstrand, 1999) Numerous definitions of innovation have been suggested over the years. Schumpeter defines innovations to be "*doing things*

differently in the realm of economic life" (Sweezy, 1943 p. 93). Another definition, given by OECD & Eurostat (2005), states that *"an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations*" (OECD & Eurostat, 2005, p. 46). Although several definitions of innovation have been presented, they all share two main principles; 1) an innovation is something that is new to the world, and 2) the innovation has to be useful and have commercial applications. This is the definition that will be used in this report. This Schumpeterian view of innovation distinguishes between five types of innovations: (OECD & Eurostat, 2005 p. 29)

i) Introduction of a new products
ii) Introduction of new process of production
iii) Opening of new markets
iv) Development of new sources of supply for raw materials or other inputs
v) Creation of new market structures in an industry

The concept of *diffusion* refers to the spread of innovations among different actors. Granstrand (1999) and Rosenberg (1982) argue that an innovation is not just one single isolated event, but rather a process where the innovation and its technology typically changes during its diffusion. These changes and improvements of an innovation partly come as a result of buyer and seller diffusion. *Buyer diffusion* implies a statistical measure of the number of new individual adopters over time. Changes from buyer diffusion come as a result from adaptations to suit the needs or specialized requirements of different users. Users often help to develop the products, which allow new applications and ideas to come up. *Seller diffusion* implies a statistical measure of the number of new imitators over time. The notion of imitation is by Granstrand (1999) defined to be *"a close reproduction or near duplication of ideas, practices or objects that was once perceived as inventions (or innovations)."* (Grandstrand, 1999, p.59). Viewing it from the seller side, changes occur as a result of imitations being copies with modifications. Since innovations are novelties, imitations require adaptation to different production equipment, inventing around patents, product differentiation and new ideas, which spurs significant changes and developments. (Grandstrand, 1999)

The diffusion process often results in minor improvements, but from time to time radical changes are also present. Innovations are characterized to be *radical* (discontinuous) or *incremental* in its nature, depending on the "size" of the change and its impact on the industry. Discontinuous innovations results in major disruptive changes as they present entirely new concepts. (OECD & Eurostat, 2005) Kaplan (1999) describes discontinuities as technology breakthroughs that give the advantage to reconstruct industry rules or help companies to create entirely new industries with a totally new set of competitors, that are putting emphasis on imitating and making improvements as an attempt to increase the customer value. (Kaplan, 1999) Incremental innovations on the other hand are smaller improvements that are necessary to continuously advance in line with the changing industry environments. (OECD & Eurostat, 2005)Incremental innovations on the other hand are smaller improvements that are necessary to continuously advance in line with the changing industry environments. (OECD & Eurostat, 2005)

Innovation is acknowledged as an important pillar of economic growth (OECD & Eurostat, 2005, Rosenberg, 2004). One notion stressing this is the concept of "*creative destruction*", derived from the work of Schumpeter. The concept emphasizes innovation as a driver of economic development through the dynamic process where new technologies replace the old ones. This dynamic process of innovation activity differs from industry to industry in terms of speed and radicality, but also in terms of linkages and environmental factors. While some industries are characterized by rapid and radical changes, others are slow and incremental in their development. (OECD & Eurostat, 2005) Rothwell (1984) argues that the innovation process is closely linked to supply and demand factors, as well as environmental factors (e.g. regulations). In order to establish an infrastructure that is innovation friendly he suggests a number of issues that needs to be tackled. Firstly, on the supply side, he highlights that building up local capabilities and providing financial support (e.g. venture capitals) as well as technical assistance through the establishment of scientific and technological infrastructure is important. Secondly, on the demand side, he underlines that governments can provide incentives to innovate by the act of purchasing innovative products and services from local firms.

For the supply side, the decision whether or not to innovate generally takes place under great uncertainties. It is no doubt that the future is hard to predict and how future

developments, in terms of knowledge, technologies, markets and product demand and how these will turn out, even though it may vary based on the industry. Thus, Rothwell (1984) argues that governments need to create incentives to stimulate supplier innovations. For instance, by creating a demand on the market, these uncertainties can be reduced. There have been initiatives to increase the innovativeness at the local level across Western Europe through the introduction of science parks, university innovation centers and enterprise zones. Yet, the main problem in such incentives is that it only deals with some of the elements of the problem and results in only limited success. (Rothwell, 1984)

2.2 The innovation system (IS)

As introduced in the previous section, the innovation process works within a system. The support and impact from surrounding actors and factors is vital for the innovation process. A very abstract definition of a system, given by Carlsson et al., (2002), expresses it as *"a set of interrelated components working towards a common objective"* (Carlsson et al., 2002 p. 234). What this definition tries to emphasize is that the components within a system consists of different actors or organizations that are linked and influence the entire system, each with its specific properties and behaviors. The interaction (feedback) between these components makes the system dynamic. The relationship between these interrelated components is severalfold. The actors of the system may compete with each other, but also collaborate and from time to time they perform transactions, in terms of trading goods, services and/or knowledge. Furthermore, for actors to perform certain activities, institutions and policies regulate and set incentives to direct these in a certain direction and sometimes to avoid others. Although, even the linkage between institutions may sometimes be supportive towards each other and other times be in conflict. (Markard & Truffel, 2008) However, it is important for the system to progress in the right direction to be able to survive in the continuously changing environment (Carlsson et al., 2002).

Technology acquisition and transfer is a significant part of innovation systems and these take place through market and non-market interactions. Technology transfer is by Carlsson et al. (2002) stated to be the core activity in an innovation system. The technology can be transferred both intentionally and unintentionally (or accidentally). In both cases, the investments in time and effort are large for the receiver. The unintentional (or accidental) transfer of technology is by Carlsson et al. (2002) referred

to as “technology spillovers”. Technology acquisition relates to a collaborative process that stretches over a period of time. The interaction (feedback) among the actors of the system results in that the system configuration changes over time and this is according to Carlsson et al. (2002), based on that the capabilities changes and grows over time.

The capabilities of the actors of the innovation system, in terms of generation, diffusion and utilization of technologies to create economic value, play a key role. These capabilities together represent techno-economic competence, which is defined as the ability to make use of business opportunities (Carlsson et al., 2002). The techno-economic competences involves four elements of capabilities; *Selective (strategic) capability* refers to the ability of making the “right” strategic selections of innovative markets, products, technologies and organizational structure through a thorough examination of technological and economic information. An important part of this capability is the ability to acquire core knowledge, data, and competence that are required to develop technologies. The second is *organizational (integrative or coordinating) ability*, which includes the competence to meet the overall expectations of the organization by organizing and coordinating its resources and financials. This also involves the ability to discover new ways of using already existing knowledge and skills to create and improve technologies. Thirdly, *functional ability* is an efficiency capability, which includes the skills to implement and utilize technologies effectively through the use of different functions in the system. Lastly, the *Learning (adapting) ability* is important for the long-time survival and covers the capability to learn from former successes as well as failures, and the ability to adapt the diffusion of the technology throughout the system with suitable actions based on what the market signals. (Carlsson et al. 2002)

There are different aspects of the innovation system including different levels, such as national, regional, sectoral or technological systems. In this report, the focus will be at the national level. Carlsson et al. (2002), Markard and Truffer (2008) highlights that national innovation systems framework views the system from a broader perspective and goes beyond the input/output system consisting of industries and firms to bring in the influence and interaction of other actors and organizations. The components of the system include besides R&D activities also the role of universities, research institutes,

government agencies and government policies, and the linkages between these are looked at on an aggregated level. (Carlsson et al., 2002, Markard & Truffer, 2008)

Viewing public procurement of innovations from an innovation system perspective, at least two main actors are collaborating, the public procurers and the suppliers. In an abstract level, the public procurement of an innovation goes about solving a "problem" by evaluating potential solutions attained from suppliers. However, this requires that the knowledge about the problem is transacted to the suppliers as well as the reversed, available solutions needs to be transacted to procurers. Furthermore, policies aims at shaping the interaction between these actors by stating the "rules of the game", therefore understating these rules is essential in order to understand the public procurement of innovations (Edler & Georghiou, 2007, Rolfstam, 2009). The interaction between the procurers and suppliers also concerns aspects such as how the collaboration between these two actors works. Edqvist et al. (2000) argues that a close collaboration between procurers and suppliers is an element that is necessary in order to achieve an effective public procurement of innovations (Edqvist, C., Hommen, L., & Tsipouri, L., 2000).

2.3 Public procurement

Public procurement is in this report defined as procurements that are regulated by the Swedish law *(2007:1091) "Lagen om offentlig upphandling"*[1] (LOU). The LOU is in turn mainly based on the EU-directive 2004/18/EG (Fryksdahl & de Jounge, 2011, p.6). The purpose of regulating public procurement within the European Union is to ensure a working market where both goods and services can travel freely from sellers to buyers and ensuring and making this market efficient. In Sweden, the Swedish Competition Authority has the responsibility of being a supervisory authority and make sure that the companies comply with the law.

2.3.1 What/who is covered by public procurement regulation

Several authorities and bodies are covered by the public procurement regulation. Firstly, government and municipal controlled authorities are covered. There is also a second category, governmentally or municipally owned public companies. Thirdly, publicly controlled bodies and institutions are also covered by the regulation.

[1] http://www.riksdagen.se/sv/Dokument-Lagar/Lagar/Svenskforfattningssamling/Lag-20071091-om-offentlig-u_sfs-2007-1091/

More specifically, what is covered is the actions taken when the above mentioned authorities are allocating a contract or form a part of a framework agreement of goods, services or construction contracts. (Fryksdahl & de Jounge, 2011, p.7). However, there are also some exceptions of procurements made by the above-mentioned authorities, which are not covered by the LOU. These exceptions are not considered in this report as they are believed to be insignificant to our research questions.

2.3.2 Principles of public procurement

There are five basic principles of public procurement stated in the LOU, these are 1) the principle of non-discrimination, 2) the principle of equal treatment, 3) the principle of transparency, 4) the principle of proportionality, and finally 5) the principle of reciprocal acknowledgment.

The first principle; the principle of non-discrimination, essentially means that the public procurer cannot frame the requirement specifications in such a way that it is only possible for, let's say local or national suppliers, to deliver. All companies, irrespective of physical location or nationality (within the European union), should compete on the same terms and conditions. (Fryksdahl & de Jounge, 2011)

The second principle; the principle of equal treatment, is somewhat intertwined with the first principle in terms of not giving any company an advantage over another. However, it more specifically deals with the treatment. Not only can the public procurer not discriminate a supplier based on nationality, it must also give the same information to everyone at the same time. Otherwise one supplier could get a significant advantage over other suppliers. (Fryksdahl & de Jounge, 2011)

The third principle; the principle of transparency, says that a public procurer must be open when it comes to what exact requirements the suppliers need to fulfill and how their quotes will evaluated and ranked. In this way, the decisions later made by the public procurer will be predictable and less shady. For example: if more than one supplier fulfills the specified requirements, will only one be chosen? and if so, which one? It could be the cheapest, or any other criterion such as being the most energy efficient solution. (Fryksdahl & de Jounge, 2011, p.7)

The fourth principle; is the principle of proportionality. It states that the requirements on the suppliers and one the required solution should be proportionate and have a connection to what is procured (Fryksdahl & de Jounge, 2011, p.7). In other words, the procurers may not put unnecessary or irrelevant requirements in relation to what is needed.

The fifth and final principle; the principle of reciprocal acknowledgment, states that for example certificates issued by another member nation of the European union also should be considered valid and accepted in the procurement process, irrespectively in what nation the procurement takes place. (Fryksdahl & de Jounge, 2011)

2.3.3 The process of public procurement

Public procurement is a process that contains three main phases. Firstly, a need is identified followed by an analysis of the need and how it can be met. This can be seen as a planning phase. The planning phase ends with an advertisement of the need and continues to the procurement phase, which is initiated by the process of excluding of suppliers. After the exclusion of suppliers (if any), a process of qualifying suppliers takes place. Having qualified suppliers, an evaluation of the different quotes is performed. The second phase is finalized with assigning a contract to the best supplier(s) according to the evaluation previously performed. A more specific contract is written with the assigned supplier(s), which is then followed during the third phase as regulated by the contract. During this third and final phase, follow-ups could take place to evaluate the performance during the period of the contract. The process of public procurement can be summarized as in *Figure 2* below. (Fryksdahl & de Jounge, 2011, p.10)

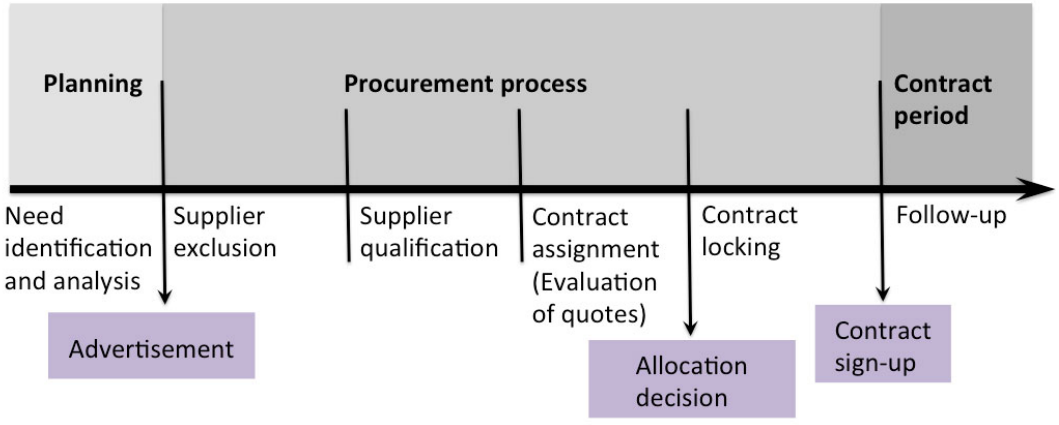

Figure 2 The procurement phases. Adapted from Frykdahl & de Joung (2011)

The following subsections will go through each of the steps in the public procurement process as depicted in the model above (*Figure 2*).

2.3.3.1 Need identification and analysis

The process of public procurement begins with a need that arises for the public procurer. The need could for example be a need of new computers, a need for additional buildings to be built etc. A need does not have to be of a product, it could also be a need of a service; for example cleaning or maintenance. This planning phase is not formally a part of the procurement regulations. The need is then analyzed and formalized into a written form, following a set of requirements, to be used in the next step in the procurement process. (Fryksdahl & de Jounge, 2011)

2.3.3.2 The advertisement of the need

What is particularly relevant to this report is to dig somewhat deeper into the advertisement of the need, as this is a very important part of the communication between public procurers and the suppliers. Depending on how this is done, it could more or less favor suppliers with innovative solutions.

In this step, the procurer leaves the planning phase and enters the procurement phase. The need is advertised publicly in a national database, and if the value of the procurement is believed to be above a certain threshold, the procurer must also advertise it in the European database to make it easier for suppliers in other countries to respond as well. Suppliers can subscribe to these databases and thereby get notified and gain access to the needs of the procurer. Suppliers interested in participating in this procurement can then respond to the procurer.

According to the LOU, the above mentioned advertisement shall at least contain the following five points; 1) the requirements on the supplier (e.g. economic position, technical capacity etc.), 2) requirement specification or assignment description, 3) evaluation base (e.g. lowest price, the evaluation criteria for evaluating the most beneficial quote etc.), 4) commercial terms during the contract period (e.g. payment and delivery terms) and finally 5) administrative arrangements for the procurement (e.g. final date of quote, validity period of the quote etc.). In addition to the above-mentioned points, the procurer *may* also have special demands when it comes to how the contract is

implemented, such as social and environmental considerations. (Fryksdahl & de Jounge, 2011, p.14)

The technical specification, related to the second point in the advertisement of the need, should be as precise as possible. It should furthermore conform to one out of two principles, either 1) performance or functional need, or 2) a reference to different standards. What is more, and an important characteristic of public procurement, is that the specification may not reference to a particular brand or origin. (Fryksdahl & de Jounge, 2011, p.14) Everyone should have the same chance to get the contract irrespective of brand.

2.3.3.3 Supplier exclusion and qualification

In some cases, suppliers are (should be) excluded from the procurement. One reason for this could be that the supplier has been associated with criminality of certain types e.g. economic criminality such as money laundering, fraud or corruption, or are participating in organized crime. Suppliers may also need to qualify by having access to certain production capacities or being in good financial standing. (Fryksdahl & de Jounge, 2011)

2.3.3.4 Evaluation of quotes

The evaluation base (related to the third point of the requirement specification) should be one out of two options, the procurer should select the supplier that quotes either 1) that is considered to be the most economically favorable option, or simply 2) the supplier that quotes the lowest price. If the first option is chosen, the criteria behind the evaluation must also be stated by the procurer. (Fryksdahl & de Jounge, 2011, p.15) These criteria reflect the third principle of public procurement; the principle of transparency - how the procurer will evaluate the quotes must be available to the suppliers prior to them giving their quote. (Fryksdahl & de Jounge, 2011)

2.3.3.5 Allocation decision, contract locking and contract sign-up

Having evaluated the quotes from the qualified suppliers, the winner(s) are selected. All participants need to be informed of the decision along with the information behind it. If there is to be a so-called contract lock, i.e. the procurer cannot enter into other contracts during a certain time interval, this information must also be conveyed. Contracts are formed based on the quotes, and finally signed by the two parties. (Fryksdahl & de Jounge, 2011)

2.3.3.6 Follow-up

The final step in the procurement process is evaluation and follow-up of the contract and delivered goods and/or services. The law of public procurement does not regulate this step. (Fryksdahl & de Jounge, 2011)

2.3.3.7 A circular model

It is also possible to look at the process of public procurement as a circular process as shown in Figure 3 below (Ecopol, 2012). This view is very similar to the linear model described above; first a need arises and is expressed by the procurer. Then, there is a connection with the market of available suppliers. Using applicable policies stated by different sets of institutions at both European, national, and regional levels a supplier is selected and the procurement takes place. Goods or services are then delivered according to the terms specified in the contract and is used by the procurer. After having used the goods or services, an evaluation is made. Based on the evaluation and new needs that has arisen the process starts over again.

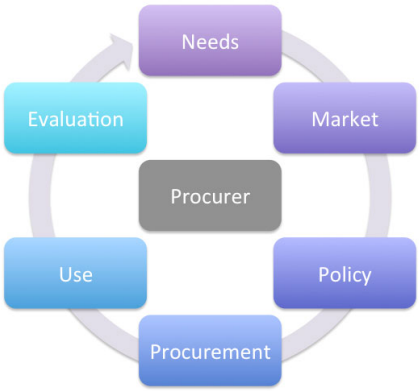

Figure 3 A circular model of public procurement. Adapted from Ecopol (2012)

2.4 Public procurement of Innovation

Policy-makers in the European Union have in recent years gained new interest in public procurement as an instrument for stimulating innovations. (Edler & Georghiou, 2007, Rolfstam, 2009). However, before building on this point, it can be useful to reflect on what public procurement of innovation is. Rolfstam (2012) defines it to be *"purchasing activities carried out by public agencies that lead to innovation."*, (Rolfstam, 2012, p.5) This definition denotes that public procurement can take place at any level in the society, may it be in a department in a local council of a municipality, or on the regional, national or global level. (Rolfstam, 2012)

Rothwell (1984) quotes Herbert and Hoar (1982), stating that "*governments usually goes for the cheapest products that met the minimal design standards. Not surprisingly, these were also the simplest and most basic incorporating technology that lagged significantly behind that available to private consumers"* (Rothwell, 1984; Herbert and Hoar, 1982). Having stated this, Rothwell (1984) highlights three strategic public procurement activities as a potential to stimulate and diffuse technological innovations; 1) the creation of new markets, 2) the creation of "demand-pull", and 3) the government taking the role as a "prototype tester". Firstly, the public procurement can have a direct impact by using their large purchasing power as a means to create markets that has more of a "radical" characteristics, with products and services that goes beyond "state-of the-art" (Rothwell, 1984). There are purchases of innovations to fulfill the government's own mission, which is the original idea, but also for use by the society, which goes about to support private purchasers in their decision to buy (Edler & Georghiou, 2007, Rothwell, 1984). Secondly, expressing the requirements in functional or performance terms can create a "demand-pull". Since demand factors in many cases are the main driver of innovation (OECD & Eurostat, 2005), this approach of expressing the needs in more wide terms, Rothwell (1984) argues would allow the industry to respond in more creative and innovative outcomes. This market would later work as an influence for the industry to develop the work. The third point that Rothwell (1984) brings up is that public procurement provides a market that works as significant testing ground for new innovative products. The product performance can be screened and give information that might be valuable for further R&D investments for future modifications and improvements, which could be of importance to regulatory agencies, as they require certain national objectives to be met. (Rothwell, 1984)

A very important factor that might affect the ability to influence technological change through public procurement is identified by Rothwell (1984) to be the stage of maturity that the product and the industry are in. The possibility to have the greatest impact on technological change through procurement incentives is when the product and industry are in the early phases of their development. Mature products will only result in improvements that are incremental and not major changes. (Rothwell, 1984)

2.5 Customer types

There are different types of customers. They differ along several dimensions, for example at what (relative) point in time they choose to adopt a certain product or

technology (i.e. they could be early or late), and the degree of involvement (i.e. the customer can be very involved in the development of the product or they could simply buy what is already available off-the-shelf). In this section, we will first deal with the degree of involvement in subsection 2.5.1 - Lead users, followed by the subsection 2.5.2 which mainly classifies customers based on how relatively early or late they are.

2.5.1 Lead users

von Hippel (1986) defines the term *"lead user"* as a user that fulfills the following; 1) they are users *"whose present strong needs will become general in a market-place months or years in the future"* (von Hippel, 1986, p.791), and 2) they also, in an attempt to fill their need *"they can provide new product concept and design data as well"* (von Hippel, 1986, p.791). Herstatt and von Hippel (1991), in an attempt to interpret von Hippel (1986, 1988) as lead users have two main characteristics; 1) *"They face the needs that will be general in a marketplace - but face them months or years before the bulk of that marketplace encounters them"* (Herstatt & von Hippel, 1991 p.1), and 2) *"They expect to benefit significantly by obtaining a solution to those need" (*Herstatt & von Hippel, 1991 p.1).

Using only the first criterion of each of the above-mentioned definitions, lead users would simply be an "innovator" or an "early adopter" according to the definition in the following section. However, and most relevant to this report, is the second criterion. The customers' need and demand is great and of significance, but unmet by the current market. This could create incentives for them to either develop a solution themselves or interact with a developer that can. This behavior is interesting to this report as it takes the potential of promoting innovation one step further. Instead of only promoting innovation (or being innovation friendly) by procuring based on functional or performance terms, they could potentially assist in the development of new innovations.

2.5.2 Early and late adopters

There are different diffusion/adoption models for innovation. One that is commonly used to describe the diffusion of innovation is the bell shaped normal distribution curve, see *Figure 4*. The principle is that the adoption of innovations starts off relatively slow, then takes off and accelerates until a peak is reached and thereafter the adoption slowly decreases and finally comes to a halt. Rogers (1962) introduced a classification system that classifies the type of adopters typically found in different phases of the diffusion.

The first classification is *innovators*. They are the ones that are more than willing to try something new and different. In fact, those are, as the name implies, innovating and actually help pulling the change. The second classification is the *early adopters*. They are, as the innovators, one step ahead of the majority of adopters. They are willing to try new ideas, but in a more careful way. They could nevertheless be respectable people and therefore important opinion leaders. The third classification is the *early majority*. The early majority does accept some change, and do so more quickly than the average adopter. Following the early majority is the *late majority*. These are more skeptic people, and they wait until the majority has adopted and has been using the innovation for a while before they are willing to adopt it themselves. Finally, the fifth at last classification is the *laggards*. If the late majority was skeptical, the laggards are even more skeptic and preferring to wait until after a new innovation has become mainstream or even tradition before they adopt it.

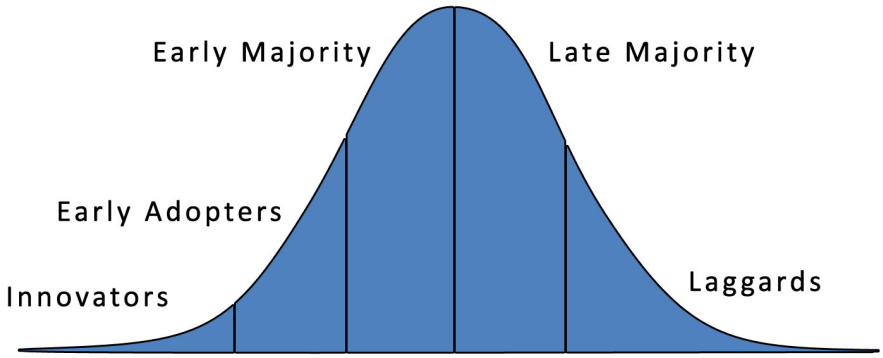

Figure 4 The innovation adoption curve. Adapted from Rogers (1962)

The classification above is useful for several reasons. First of all, it helps to understand that diffusion of new ideas takes time and is not something that happens overnight. Secondly, everyone does not automatically and immediately have a demand for new product, even if it has better performance characteristics than current products.

One implicit assumption of using the above mentioned technology adoption curve to describe adoption in different phases is that the rate of adoption smoothly follows the curve and that immediately after the innovators follows adoption from the early adopters, and immediately after the early adopters, the early majority will start adopting the innovation etc. This is according to Moore (2006), however, not the case in reality. Moore (2006) states that there are "cracks" in between the different; one between the innovators and early adopters, and one between the early majority and the late majority. There is also, perhaps more importantly, a crack between the early adopters and the

early majority. This crack is, according to Moore (2006), much wider and deeper than the other two and is referred to as the *chasm* rather than just a crack. The transition from one side of a crack to the other can be difficult, but the real challenge is the transition of the chasm. These difficulties are very well described in Moore's (2006) book "Crossing the chasm", which has received a lot of attention over the years.

It is important to recognize that these different sets of adopters, and their corresponding characteristics and adoption behavior. While the innovators and early adopters are more prone to adopt a new type of technology, the majority of customers are not that easily convinced and require others to adopt the new technology before they do it themselves. This could be seen as a Catch 22 situation (Moore, 2006 p.20); if a majority of customers waits for the majority to adopt before they do, you can end up in a deadlock and new and revolutionary technology could be trapped while trying to cross the chasm. One could argue that is enough for a company to simply sell their new product to the innovators and early adopters. However, although being more easily convinced to adopt and being more forgiving when it comes to flaws in early prototypes, their acceptance comes at a price. The innovators and early adopters are usually more price sensitive; they do adopt new technology "because it is cool", but they do not want to pay a price premium since they are more forgiving. They are thus more difficult to earn much money on and for a company to be profitable.

3 - Methodology

The research methodology of the thesis is described in this section. This includes the research design, data collection methods, sampling approach, data analysis and finally reflections of research quality. The process of the research conducted in this study has been following the model suggested by Bryman and Bell (2011, pp. 389-392) for qualitative research. Figure 5 gives a brief outline of this process.

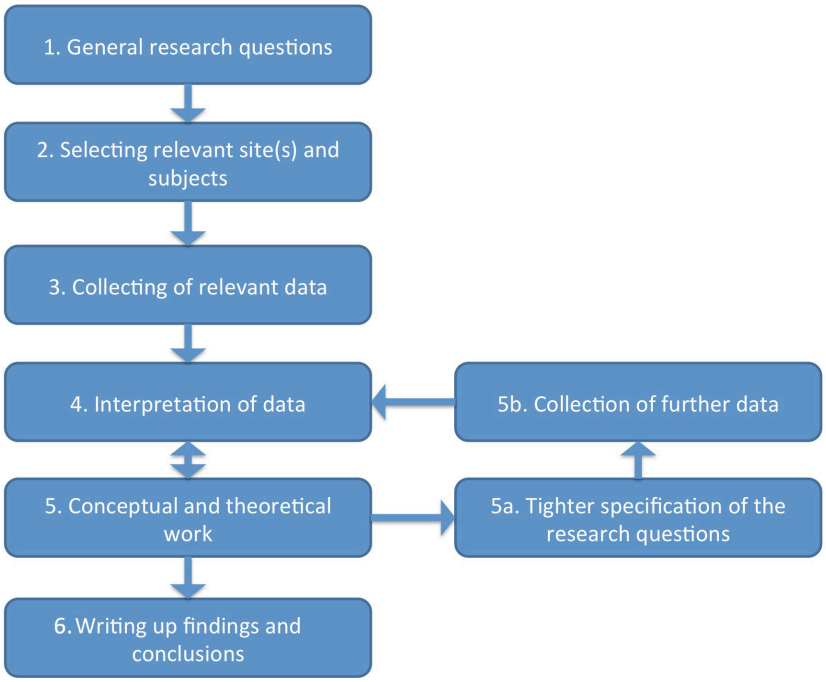

Figure 5 The qualitative research process. Adapted from Bryman and Bell (2011, p. 390)

Step one is to generate general research questions. In this step, input from SP through unstructured interviews related to public procurement and innovation has been important. A more detailed description of how these unstructured interviews were conducted can be seen later in this chapter. These interviews resulted in a general topic area of interesting research questions to pursue, however, as our knowledge of this area at the time was relatively low, precise research questions could not be formed. Step two is to select relevant subjects to collect data from. Based on the general research questions from step one, it was decided to treat both sides of public procurement, the procurer themselves, and the suppliers of innovative products as subjects of investigation, and continue with unstructured interviews with representatives from SP and also to gather cases from public documents. A more thorough explanation of the sampling (i.e. which subjects were selected for interviewing and study) can be seen further down in this section. Step three includes collecting data from the subjects identified and selected in step two. The methods used to collect this data are each

described in their own subsection of this chapter. Step four is to interpret and analyze the collected data. This interpretation and analysis of this data has been conducted with the help of the literature review, which were described earlier in section two. Based on this work, refined and narrowed research questions were formulated, which in turn impacted what data that was needed to collect. This process was done repeatedly and converged in the sixth and final step, which is to write up the findings and conclusions. When writing up the findings and conclusions, it is important to convince the audience of the significance and validity of the research (Bryman & Bell, 2011, p.153).

3.1 Research design

According to Bryman and Bell (2011, p.40), a research design provides a framework for the collection and analysis of data. The research design of this study consists of three different parts, one for each type of source of data; procurers, suppliers, and examples of successful functional procurement. Since our research questions are of qualitative nature and the questions are of "how"-type and "what"-type, the multiple case study design has been chosen for all three parts. A multiple case study design is well suited to compare different cases and find *"what is unique and what is common across cases"* (Bryman & Bell, 2011, p.63). The multiple case study design will therefore help us identify what characteristics and interests that are common and less common for both procurers, and suppliers and also to identify individual aspects that are interesting to our study.

For a more detailed description of how and which research methods has been used to collect the data, see the following section 3.3 *Research Methods*.

3.2 Sampling approach

The need to sample is one that is almost invariably encountered in quantitative research (Bryman & Bell, 2011, p.175). Although mostly associated with quantitative research, it also applies to qualitative research. Unfortunately, the lack of transparency is sometimes a feature of qualitative research, particularly apparent in relation to sampling (Bryman & Bell, 2011, p.489). Bryman and Bell (2011, p.489) further notes that it is sometimes impossible to discern how the interviewees were selected and how many of them there were.

In this report, we will be explicit when it comes to these factors; how many that were interviewed, which companies and authorities interviewed and how these were selected. Exactly how this was done varies slightly depending on which research method used and what type of interviewees interviewed, and will be elaborated more in detail further down in this chapter. However, the main sampling method has been convenient sampling. The reason why we have chosen this sampling method is since it allows us to pick companies that we believe were able to answer our questions better and also due to resource constraints. Therefore, with a given set of resources, more useful data can be attained. A more formal definition of convenience sampling is justified and will be presented in the following paragraph.

Bryman and Bell (2011, p.190) defines a convenience sample as a sample that is simply available to the researcher by virtue of it accessibility. A convenience sample is a non-probability sample, which means that there is a risk that some units in the population are more likely to be selected than others. This sampling method comes with a serious drawback, namely that it is impossible to generalize the findings to a larger population than those that were actually interviewed (Bryman & Bell, 2011, p.190). However, Bryman and Bell (2011, pp.190-191) argues that this is not to suggest that convenience samples should never be used, as other probability based samples are frequently avoided due to the difficulty and costs associated.

Another important aspect of sampling is the sample size. In fact, how many interviewees to select for interviewing is a question frequently asked by students of both undergraduate and postgraduate level when writing their research projects (Bryman & Bell, 2011, p.490). There is, however, no easy answer to this question. Let alone the fact that there is no perfect answer to this question. What is to be considered enough also varies from one university business school to another, word limits, time available, the attitudes of the people running the course, and expectations of the supervisor (Bryman & Bell, 2011, p.490).

In this report, we have decided to use a contingent approach where the number of interviews was not set in advance, but rather decided during the interviewing process based on the consistency of the obtained findings. Once the growth of knowledge on an aggregated level decreases as the number of interviews grow, there is a point where the

resources spent per interview does not justify the increased knowledge obtained from that interview. In other words, when you start to get the same or very similar answers from different sources, the amount of interviews is enough.

Contrary to the common belief in research, where sample bias, which could be defined as "*a distortion in the representativeness of the sample that arises when some members of the population [...] stand little or no chance of being selected for inclusion in the sample*" (Bryman & Bell, 2011, p.176), is considered as an "error" and thus should be avoided; there is also a second view on this matter. There is a concept called *purposive sampling* where the researcher on purpose creates sample bias by deliberately choosing or favoring a certain type of subjects of investigation. The basis for this would be of they are more likely in their ability to contribute to theoretical understanding of a subject (Bryman & Bell, 2011, p.492). As was mentioned earlier in this section, convenient sampling has been used in this study. The possibilities to generalize the findings are thus already somewhat reduced. Reducing it further by using purposive sampling has been decided to be justified as the benefits of finding more interesting subjects of investigation which to a greater extent provides to the theoretical understanding of the area under investigation outweighs the drawbacks. The specific method of selecting subjects for interviewing will elaborated more thoroughly further down in their respective sub section as the procedure has been different depending of which type of interviewee that is of interest (i.e. being either public procurer or supplier of innovation).

3.3 Research methods

A research method can be defined as *"a technique for collecting data"* (Bryman & Bell, 2011 p.41). This study consisted of several research methods. For collecting primary data, the main source of information has been unstructured and semi-structured interviews. As an attempt to understand the perception of public procurers and the reasoning behind their actions, interviews was the data collection method that best fitted this approach. Secondary data has been collected by surveying available literature, documents, and reports, relevant to this thesis since it allows collecting useful data from a wide range of sources otherwise not possible to attain using the resources available in conducting this research.

In order to answer the research questions, several steps of data collection were performed sequentially. Firstly, several open interviews with representatives at SP was conducted in order to get an overall understanding of the topic, including an introduction to and explanation of how public procurement works. As this report is to be delivered to SP in the end, discussions related to the purpose and contents of the report has also been discussed with them. In order to answer the research questions, primary data was collected through semi-structured interviews with public procurers and suppliers of innovative products as will be described further down in this section. Semi-structured as well as open interviews are the two main types of interviews in qualitative research (Bryman & Bell, 2011, p.465). In parallel, secondary data was collected and provides useful data to compare and contrast with the primary data. The use of the secondary data will also be described more in detail further down in this section.

3.3.1 Unstructured interviews

Unstructured interviews, also called open interviews, are one of the main types of interviews in qualitative research (Bryman & Bell, 2011, p.465). An open-ended interview could be based simply on an *aide-mémorie* with a range of topics that are intended to be brought up under the interview (Bryman & Bell, 2011, p.467). In quantitative interviews in general, and in open interviews in particular, the discussion can depart significantly from the original intended topic of the interview. With these interviews, the purpose is to get rich and detailed answers, as compared to structured interviews associated with quantitative research (Bryman & Bell, 2011, p.467).

During the entire process of writing this report, regular unstructured interviews was conducted with representatives from SP. These interviews were conducted of two main reasons; first of all, to get an overview of the area of research from experts within the area, and secondly to discuss and form the focus and general direction of this report. SP has also provided us with invaluable help of explaining how procurement works, their view on why they work in that way, and have also provided with several important secondary sources of information as will be described in the *3.3.3 Public documents* section below. These unstructured interviews are of highly qualitative nature, and the results are hard to link to the research questions in a direct manner. However, they indirectly help by giving information of the context of which the research questions are stated.

3.3.2 Semi-structured interviews

Semi-structured interviews have, unlike the open interviews, a more formal list of topics to be covered (Bryman & Bell, 2011, p.467). This list is sometimes referred to as an interview guide, and this will be the term used throughout this report. However, despite this list, the interviewer can ask other questions not present in the interview guide if an interesting answer is given in a previous question (Bryman & Bell, 2011, p.467). These interviews are thus a balance of flexibility as well as provide a base for comparison between the interviews. Two examples of factors leaning towards using semi-structured interviews is mentioned by Bryman and Bell (2011, p.473), if more than one person is carrying out the "fieldwork" as well as if a multiple case study is performed and comparison between the cases are needed. In this report, both these factors are being fulfilled.

The main principle of how the interview guides was constructed follows *Figure 6* below.

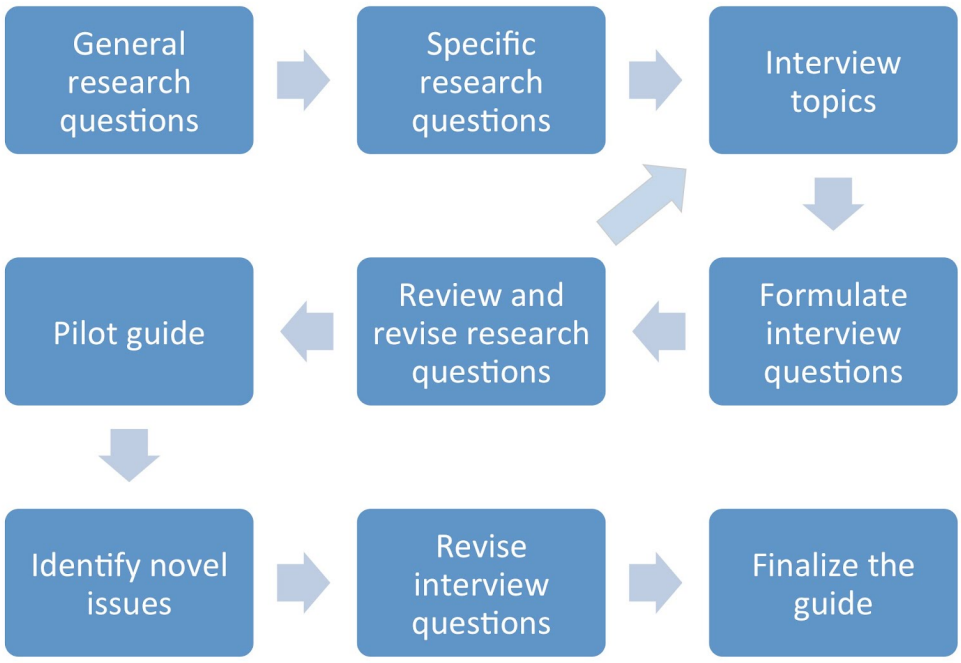

Figure 6 Formulating questions for an interview guide. Adapted from Bryman and Bell (2011, p. 477)

The principle is that, based on the research questions, interesting areas of investigation are identified. Based on these, more specific questions were formulated to use in the interview guide. The questions were then reviewed by both the authors of this report,

the supervisor at Chalmers and the supervisor at SP. Following this, a few interviews were conducted as a pilot study and the questions were further revised and then the final interview guide was established.

Semi-structured interviews constituted the main part of the primary data collection. The interviewees can be categorized into two main categories; 1) publicly owned companies and institutions (both covered by the LOU), and 2) entrepreneurial companies with innovative products. Semi-structured interviews offers a good balance between structure and flexibility; it ensures that the set of questions decided beforehand are asked, but it also allows adding more questions outside the template as the interview proceeds if an interesting answer pops up. The interview templates used in this report can be seen in appendix 1 and 2. The semi-structured interviews have mainly been of qualitative nature, although some of the questions allows for quantitative comparison and statistics.

When interviewing publicly owned companies regarding public procurement, three pre-test interviews were conducted. During the first interviews, the question template was revised and improved based on the interview and as our knowledge and understanding of the respondents grew. The pre-testing continued until the question template was working well and there were no need to change it anymore. The same principle was used when interviewing suppliers, where the first three interviews were used as a pre-test. The interviews conducted during the pre-test phase has not been included in the quantitative measurements in the empirical section as the questions were changed in between the interviews. However, some useful qualitative information was gathered also from the pre-test interviews.

All interviews have been conducted in Swedish since, all interviewees are Swedish speaking, the research is done in Sweden and the researchers both speak Swedish. As this report otherwise is entirely in English, the need to translate notes and quotes from the interviews into English arises. This raises potential language and translation problems associated with collecting data in a language other than English and then translating into English for the purpose of writing for example an dissertation (Bryman & Bell, 2011, p.488). In this report, we try to mitigate this problem by making the very same person conducting the interview to be responsible for the translation of the data if

such is required. Therefore, it is more likely that the essence and original intentions are preserved.

The semi-structured interviews were performed with six public procurers and five suppliers. Why and how these were chosen as well as the key findings from these interviews is presented in the empirical findings, in chapter four.

3.3.2.1 Public procurers

The sample population of public procurement is all publicly owned companies and authorities covered by the LOU, as defined in section 2.3.1. The sampling method used has been convenient sampling, simply by calling companies from a list of all procurers in the Gothenburg region and selected those that had someone responsible for or informed about their procurements available to speak with us. In this study, six interviews with public procurers were conducted. Which they are and the findings of these will be presented in the next chapter. As the principles of public procurement are the same throughout the country, we have no reason to suspect that the findings of this report would be biased in any direction because of this selection.

As stated earlier, the interview template used when interviewing the public procurers can be seen in appendix 1, but as only Swedish procurers were interviewed, in Swedish, the interview template is also in Swedish. In this section, we will therefore summarize the question asked as well as motivate why they are used.

The first question aims at getting an understanding if the procurer knows about the concept of functional procurement, and that is allowed by the current legislation (the LOU) as a way of defining and expressing the procurers' need. Sub-questions include asking to what extent, if at all, functional descriptions are used in the procurement specifications. This question serves as a base for the other questions, and gives useful information whether functional procurement is used or not, which is related to our first research question.

The second question relates to the fact that there is a risk that technical requirements and referring to established standards when expressing the procurement specification could lead to a discrimination and exclusion of small or new companies with new innovative products and services. Sub-questions to this question includes if they are

aware of the problem, if they agree it is a problem, and if it affects their decisions. This question helps to tell the awareness of potential exclusion of smaller or new companies, which is important since the awareness is the first stage of solving a problem.

The third question relates to sustainable development, as it is allowed by the LOU to put both social and environmental requirements when the procurer expresses the requirement specification. Sub-questions includes if they are using these kind or requirements, and if so, to what extent and if they could give any examples. This question is similar to the one of functional procurement (question one), as it is, just as with functional procurement, one step away from only providing a strictly technical / economical requirement. It is therefore of importance to this study.

The fourth question concerns possible co-development by a procurer with a potential supplier. It is possible for a procurer to co-develop a product with a supplier and then procure it, as long as other suppliers stand an equal chance of getting the deal in the procurement phase. The procurer cannot favor the supplier, which they previously worked with in the procurement decision. Sub-question related to this area is if the procurers know that they are allowed to work in cooperation with suppliers, and if so, if they could share any examples of this. This question is of great interest to SP, as they are working on bridging the gap between research and development, and the market. It is furthermore connected to the behavior of lead users.

The fifth question is related to the surveying and scanning of the market by public procurers. Are they looking at what is out there before specifying their requirements? If so, how? Is there any risk that smaller and/or different suppliers are excluded at an early stage? How would the procurers like to come in contact with suppliers with new and innovative solutions? This question is of interest since the procurers in this phase have the chance to discover new innovative ideas and thereby increase the likelihood of actually procuring them.

The sixth and final question relates to the communication between procurers and suppliers. Do they communicate at all outside the framework of public procurement? If so, if they could give any examples. One example could potentially be to publicly

announce that *"in three years, we will look for and request XYZ"*. This question is related to one of the sub-questions of the second research question.

3.3.2.2 Suppliers (innovators)

The sample population of suppliers is all companies that do business in Sweden. In order to increase the likelihood of coming in contact with companies that has recently been involved in procurement in general and public procurement in particular, which in turn increases the likelihood of the supplier to have examples in relatively fresh memory and thus increase the relevance in the answers, the following method of selecting companies has been used. The Swedish Energy Agency (Energimyndigheten) has published a document containing a list of companies involved in procurements of innovation during the time span between 1990 and 2005.

The sampling method used has been convenient sampling, simply by calling companies from the above-mentioned list until coming in contact with one that had someone responsible for or informed about their procurements available to speak with us. The implications of this were covered in *Section 3.2 - Sampling approach.* In this study, five interviews with suppliers were conducted. Which they are and the findings of these will be presented in the next chapter.

The first question asks whether the company has been involved in a public procurement, and if so, if they could give any examples of such procurement. The purpose of this question is twofold; one is to double-check if they have actually taken part in a public procurement, and second to tell what type of product or solution it was (i.e. innovative or simply commercial off the shelf).

The second question, whether or not the product involved in the procurement was developed in co-operation with the procurer, is used as a first step of asking whether they are aware of the fact that they actually can co-develop products with a public procurer. If they have co-developed a product, they are obviously aware that they can. By co-developing a product together with a public procurer, the procurer could possibly be categorized as a lead user.

Question number three is asked to tell whether the company is aware of the fact that they can co-develop a product or solution together with a public procurer, as long as

they later on follows the regulation of public procurement in the procurement phase (meaning that they do not have automatically have exclusive rights to sell its product to the procurer, everyone should be allowed to participate in the procurement).

The fourth question asks whether they in other (non-public) procurements have been co-developing a solution together with the procurer and if they could give any examples of this. This is interesting, as it acts as an indication of whether the company in general co-develops products and solutions together with the procurer. If not, this might be a deliberate business strategy, and could explain the fact that they probably said no to the second question.

The fifth question asks whether the supplier theoretically would be interested in co-developing a product or solution together with a public procurer, despite the fact that they do not automatically gain exclusive rights to sell its products to the procurer as mentioned above. If companies are generally interested in doing this, it opens up the possibility for the procurer to act as lead user. If not, it would be hard for public procurers to act as a lead user even though they themselves want to.

The sixth question is related to the communication between procurers and suppliers. The question is if they, for example, have received information from a public procurer outside the regular procurement process and developed a product based on that information. If they have, public procurers may be acting as lead users indirectly without knowing it.

The seventh question also relates to the communication between procurers and suppliers, as mentioned in the previous question. The question asks in what ways the supplier would like to be informed of/receive information about the needs of the public procurers. The better fit between how public procurers informs the market of its needs and how suppliers want this information, the better the information within the innovation system flows which in turn helps to stimulate the generation and diffusion of innovations.

Questions eight to ten are questions stated by SP, and they are primarily of their interest. Question eight deals with whether the supplier would be motivated to participate in

public procurement to a greater extent than they currently do if they receive some kind of compensation for the expenses associated with the procurement. For example, it could practically be implemented as a fixed grant given to each participant to at least partially cover the cost of generating a quote.

Question nine deals with the perception of one potential downside of public procurement. The quote, including the specifications and estimated cost, is public and can be requested by other participants - their competitors. If a competitor requests this information, and there is something innovative and new with the solution that could be copied based on the mentioned specifications, there is a potential danger to participate in a public procurement. This question asks how the supplier perceives this potential danger.

Finally, question ten asks if the supplier would like to see other methods of evaluating the quotes by the procurer, the conventional "lowest cost" principle. It could for example be that the cost is calculated over the entire life cycle rather than the upfront cost. Taking the entire lifecycle cost, including cost for energy and maintenance, it could benefit suppliers that come up with new and "greener" technologies.

3.3.3 Public documents

Secondary analysis is of increasing interest to researchers in the field of business and management (Bryman & Bell, 2011 p.312). Secondary analysis is the process of analyzing data that was collected previously, and most likely not done by the researchers themselves (Bryman & Bell, 2011, p.313). Bryman and Bell (2011, p.313) further argues that there are numerous of benefits for students using this type of data in their research projects. One of the most prominent of these is the reduced cost and time associated with the data collection. Also, this data could potentially be of good quality, and taking part of such data often requires a fraction of the cost of conducting the research themselves. Related to the quality of the data, it is most often more representative and often collected from the entire nation rather than from a smaller region. Bryman and Bell (2011, p.315) state that *"It is certainly inconceivable that student projects could even get close to the coverage that such datasets attain"*. However, there are also, as with all data collection methods, disadvantages. One of them being lack of familiarity with the data, and that you do not have control over the data quality (Bryman & Bell, p.321).

Public documents have been used in this study. In this category, both web pages (such as company and institutional home pages, annual reports press releases), and public reports available online and offline are included. The documents were utilized to provide background information about the companies and their history (Bryman & Bell, 2011, p.550). They have also been used to identify and gather information from cases relevant to this report. Rather than searching for individual cases ourselves by contacting a large set of companies and analyze their response, which is a very time consuming task, a search for prior studies of such cases has been performed in this study. Apart from providing interesting and ready-to-use cases, public document has also been used as a source of contact details for interesting companies to perform interviews with using the data collection methods already mentioned in the previous sub-sections. Of particular interest are companies and cases related to green innovation, both development and procurement of such, as this is the field of interest of SP and the Ecopol project.

Another important source of information has been publicly available research documents. These have contributed greatly to the understanding of the field of public procurement and innovation. Furthermore, these documents form the literature review which was presented in the previous chapter, and which has been used throughout this report.

What public documents that have been used apart from the respective companies' homepages will be presented in the following chapter.

3.4 Data analysis

Qualitative data, in our case based on interviews of various kinds, creates a large set of unstructured textual material, are not straightforward to analyze (Bryman & Bell, 2011, p.571). Furthermore, *"[this could be] because, unlike the analysis of quantitative data, there are few well-established and widely accepted rules for the analysis of qualitative data"* (brackets added) (Bryman & Bell, 2011, p.571).

The data that was collected, both primary and secondary data, was analyzed differently depending on what types of subjects interviewed (i.e. procurers and suppliers), and research method that was used. Common for them all is the framework introduced in

section 1.4, where perspectives innovation, innovation systems, public procurement, public procurement of innovation, and customer types are connected and anchored to existing literature. When analyzing the data from public procurers, the *public procurers, public procurement of innovation and customer types* perspective has been used. The analysis of the data from suppliers of innovation, the *innovation* and *public procurement of innovation* perspectives has been used. To get an overall understanding of how the connection between supply and demand of innovation, both when it comes to primary and secondary data, the *innovation systems perspective* has been used.

The *innovation* perspective is used to get a definition of what innovation is, and what different types of innovation there are. This is useful when analyzing and understanding what type of innovation the procurers and companies are talking about, and what types of innovation that is mentioned in public documents. Depending on what type of innovation that is referred to, the characteristics of the requirements specifications made by the public procurer are relevant. If, for example, the goal of the procurement is to procure something with significant differences and/or improvements, the corresponding requirements specification should be in more functional terms (Rothwell, 1984).

The *innovation systems* perspective helps to analyze not only a supplier or procurer of innovation as isolated entities, but rather as a system that is connected through communication. The actors in the innovation system affect each other, which help explaining the fact that procurers can promote innovation made by suppliers. It also help explaining how the information flows between the actors, which will be analyzed in this report.

The *public procurement* perspective serves to understand and analyze the process of public procurement. By understanding the different steps of the public procurement process, and how they are regulated, this can be used to understand the buying behavior of the public procurers.

The *public procurement of innovation* perspective is the intersection of public procurement and innovation. It has been studied previously by e.g. Bröchner (2009), Edler & Georghiou (2007), Rolfstam (2009), Rothwell (1984). This perspective is the

core of this report can be used to analyze the connection between suppliers and procurers of innovation.

Finally, the customer type perspective will be used to classify the procurers based on their characteristics such as buying behavior and communication with its customers. By analyzing which customer type the public procurers are, their potential to promote and perhaps also create innovation can be analyzed.

3.5 Research quality

To ensure the trustworthiness and quality of the research, concepts of reliability, validity, and triangulation are important (Bryman & Bell 2007, p.410). Not only are they important, but also three of the most prominent criteria for the evaluation of business and management research (Bryman & Bell 2011, p.41). However, there has been some discussion among qualitative researchers concerning the relevance of reliability and validity for qualitative research (Bryman & Bell, 2011, p.394).

Reliability refers to the consistency of the results obtained, which is closely related to the replicability of the research (i.e. the likelihood of ending up with the same results if the study is done again) whereas the validity refers to measuring the right thing (Bryman & Bell 2007, pp.162-165). The difference and connection between reliability and validity can be illustrated as in *Figure 7* below.

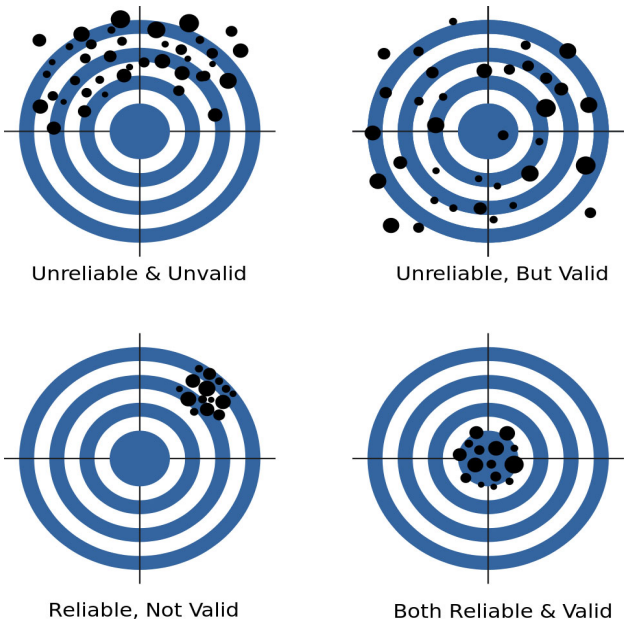

Figure 7 The relation between reliability and validity. Adapted from Wikipedia (2012a)

Triangulation is furthermore the principle of using more than one source of data for each measure (Bryman & Bell 2011 p.397). Although triangulation is often associated with quantitative studies, it can also take place within a qualitative research strategy (Bryman & Bell, 2011, p.397). Triangulation helps to eliminate errors due to a single source of information. It also helps to create a more holistic view of what is studied. In the following subsections, we will relate these concepts of research quality to our study and how we have utilized them throughout the report.

3.5.1 Reliability

One aspect, which is important to reliability, is the concept of replicability. Replicability is whether, and to what extent, the study can be repeated and reliability is if a repeated study would yield the same or similar results. Bryman and Bell (2007, pp.40-41) states that high reliability is achieved by having a well-documented research process and also to have clear research questions. In this report, we will therefore carefully describe the different steps and actions taken, for example how the interviewed subjects were selected is explained in the method section, and the interview templates that were used in the interview process is appended to this report. However, Bryman and Bell (2007, p.410) argues that qualitative research often has relatively low reliability since it is dependent upon a social setting which is dynamic and constantly changing.

When it comes to the unstructured (open) interviews with representatives from SP, the replicability is low since it is very dependent on the social interaction between the authors of this report and the representatives from SP. In addition, the interviews lasted for a relatively long period of time, around two hours, for each meeting which resulted in discussing a large array of questions that were both on topic but also a bit off-topic which contributed to a difficulty to document these interviews. Another aspect, which further complicates the replication of these interviews, is that the involved interviewees are not necessarily accessible to other prospective researchers.

The two sets of semi-structured interviews conducted with public procurers and suppliers respectively, the replicability is higher than the unstructured interviews mentioned above. This is due to the fact that the way public procurers and suppliers were selected is well described in the sections 3.3.2.1 and 3.3.2.2, and the interview guides used for the public procurers and suppliers are appended to this report in

appendix 1 and 2. Furthermore, the interviews was conducted by only two persons, and the findings of the different interviewers was critically reviewed and compared continuously to reduce the inter-interviewer variability (Bryman & Bell, 2011, pp. 202 - 203). However, as semi-structured interviews involves asking follow-up questions and adds the possibility for the interviewee to elaborate into areas found interesting to the interviewer, it is difficult to compare these with each other and assessing the reliability of these.

3.5.2 Validity

Validity can be defined as "*the issue of whether or not an indicator (or set of indicators) that is devised to gauge a concept really measures that concept*" (Bryman & Bell, 2011, p.159). There are many different ways of establishing validity on a study, whereas in this report three aspects of validity has been assessed; construct validity, internal validity, external validity. In this section the different types of validity that has been dealt with in this study will be gone through; what they are and how they have been assessed. Furthermore, as it is difficult to achieve high validity on all measurements, this section will also provide a motivation of the possible limitations that has been present.

3.5.2.1 Construct validity

Construct validity gauges if whether the measurement actually measures the concept it is supposed to measure. In other words, if what was intended to be studied was really studied (Bryman & Bell, 2011, p.160).

The construct validity of this report was mainly assessed through a comparison between the aim of this report, research questions, sub-questions and interview questions, as these are the building blocks of this study. This comparison is made in order to see how well these relate to each other and denote the concepts that it intends to. Firstly, comparing research question I with the aim of this study, the construct validity is considered to be reduced. This is based on the issue that it is truly difficult to measure the awareness of public procurers in a direct manner, which makes the concept very complex. This reasoning also goes for research question II.

Secondly, a comparison between the questions I and II with the corresponding sub-questions (I.i - I.ii and II.i - II.iii) indicates a construct validity that is higher for

question I than for research question II. Research question II asks for the role of public procurers from a wider innovation system perspective, resulting in that the question becomes almost too wide to be covered within the time limit of this report and thereby not all aspects of the innovation system is covered even though the question is formulated in that way. For instance, policies and more specifically how these affect the role of public procurers is an aspect that is very interesting to this question but not the main focus in this report. This depends on the fact that it is a subject that could have an entire report of its own and this was not possible due to time and resource constraints. Research I on the other hand, is answered through its sub-questions. Again, this shows that the construct validity for research question I is higher than for research question II.

Thirdly, the correlation between the sub-questions and the results from the interview questions is for research question I is considered to be medium, since this behavior of public procurers were triangulated with the findings of SP. The construct validity for research question II is considered to be high to medium. This is based on that the sub-questions II.i, II.ii and II.iii can be asked to the interviewees directly and is therefore considered to be high.

Furthermore, the interview questions were reviewed and modified after several pre-testings in order to reduce the risk of misunderstandings at an early stage by identify such cases in the pre-testing. This ensures a better fit of the questions and the answers, which in turn means that the answers really cover what was asked for, thus increasing the construct validity. However, the pre-testing was on a limited scale as there were time and resource constraints. Otherwise, a more detailed pre-testing could have further contributed to increased construct validity.

3.5.2.2 Internal validity

Internal validity refers to the matter of causality, meaning the level of confidence that can be placed on the cause and effect relationship on a study. Since this definition is mostly associated with quantitative research, there is another definition that is adapted for qualitative research. In qualitative terms, internal validity relates to how well the matching is between the observations of the researchers' and the theoretical ideas that is developed by them (Bryman & Bell, 2011, p.395).

The data for the research questions I and II were collected through multiple sources; through interviews and secondary data, such as public documents. Two sets of interview questions were compiled, as there were two main type of actors; one set for the procurers and one for the suppliers (innovators). The findings for each type of actor were compared in order to see the internal coherency between the interviewees, both between the interviewees within one set, and also between the two sets to obtain both sides of the subject. The internal coherency diverged in some points within the sets, for both the procurers and suppliers. However, the key findings were congruent, which increased the internal validity of this report.

The report was continuously made available to the representatives at SP in order to confirm that the researchers of this study had comprehended SP and their context correctly. Since SP, among other things, operates in the context of procurement and development of innovative solutions, this overlaps with the one of public procurers and suppliers of innovative solutions in the terms of this report. This helps to strengthen the credibility of this report; as such a supportive partner has assisted during the research (Bryman & Bell, 2011, p.396).

Connecting to both aspects previously mentioned in this section; the matching between the observations of the research and the research conducted by others, as well the credibility gained by having support from a partner such as SP; the following can be said about the internal validity based on the different questions. As the sub-question which relates to the customer type of public procurers, it is something that SP already had an idea about from previous investigations. As the findings of this research are in line with those findings, this strengthens the credibility and thus the internal validity of this report. The concept of lead user was not previously known to SP, and its relation to public procurers has little previous research, a comparison is difficult which leads to a lower level of credibility. The second set of questions relates to public procurers and the innovation system. The first sub-question regarding the knowledge and use of FRS provides high credibility. The public procurers did know what FRS was, which they should as it is one of the requirement specification types stated in the law of public procurement. When it comes to the actual use of it, less background information and theory is available and the credibility of this aspect is lower. The two last sub-questions relating to communication outside the procurement process and the related question of

co-development of solutions; the internal validity has been assessed to be medium. No theory stating whether this communication and co-development is common or not exist, but the credibility of the findings of these questions is possible to triangulate by interviewing both the actors involved (public procurers and suppliers) and their view on the subject is congruent.

3.5.2.3 External validity

External validity is concerned with how well the results of a study holds for a context that goes beyond the specific research context and hence the generalizability of the investigation (Bryman & Bell, 2011, p. 42). In order to achieve a high external validity, Bryman and Bell (2011, p. 42) suggests that generating a representative sample is essential. However, in qualitative research, deciding whether a sample is generalizable or not is difficult, thus qualitative researchers rather goes for contextual understanding than generalization (Bryman & Bell, 2011, p.411). It means that, this study searches for a deep understanding of behaviors, values, and beliefs of different actors, rather than aiming for generalization to the relevant population.

Due to differences on several dimensions for the two actors, the procurers and suppliers, the sampling consisted of two separate entities. In order to be able to use the samples as representatives, the sample size was dependent on the consensus in response from the different interviewees. Once the responses of the relevant population were reasonably coherent, the sample was considered to be representative enough. However, as mentioned in the sampling approach section 3.3, the sampling method used in this report was convenient sampling and purposive sampling, which reduces the possibilities of generalizing the samples, as has more thoroughly been described in section 3.2, which in turn is not in favor of the external validity of this report. The researchers of this study instead strived to achieve a thick description, which is detailed descriptions of the context, in order to increase the transferability and thereby also trying to increase the external validity of this report (Bryman & Bell, 2011, p.398).

Even though efforts were made as an attempt to increase the external validity of the report, the external validity for research questions I and its related sub-questions are low. Both sub-question I.i and I.ii are asking for what type of customers that the public procurers currently are, which is industry specific. Since the sample of public procurers used in this report are not representative for other types of industries and they cannot be

directly applied on other public procurers that are in industries with other industry characteristics. Therefore, the external validity for the sub-questions I.i and I.ii is low. The sub-questions of research question II indicate that the external validity for research question II is medium to low, the reasoning is as follows. The results for sub-question II.i might be applicable to other industries when it comes to the question whether if FRS is known is high but when it comes to the second part of the question, i.e. if it is adopted, it might be different based on the industry characteristics. The sub-question II.ii is mainly a matter of how the aspects of government policies are perceived and may therefore be applicable to other public procurers. Sub-question II.ii is therefore considered to have medium external validity. The same reasoning goes for the last sub-question II.iii, but this sub-question also brings in the aspects of if it is in the public procurers interest to have an influence in the development of innovations, which may be industry specific. Therefore sub-question II.iii is considered to have medium to low external validity. To increase the external validity for research questions I and II, more interviews on public procurers from different type of industries should be performed.

Research questions	**Construct validity**	**Internal validity**	**External validity**
I. Role of PPs as customers	Medium	Medium	Low
I.i. Customer type	*Medium*	*Medium-High*	*Low*
I.ii. Lead user	*Medium*	*Low-Medium*	*Low*
II. Role of PPs from an IS perspective	High	High-Medium	Medium-low
II.i. FRS known and adopted	*High*	*High-Medium*	*Medium*
II.ii. Communication outside	*High*	*Medium*	*Medium*
II.iii. Co-development	*High*	*Medium*	*Medium-Low*

Table 1 Relating each research question to validity

4 - Empirical results

In order to answer our research questions, semi-structured interviews has been conducted with both public procurers and suppliers. Furthermore, a study on existing cases of successful functional procurements has been conducted. The structure of this chapter starts with presenting a description of the Technical Research Institute of Sweden AB and its current situation. Following this, the findings from interviews with public procurers, followed by the interviews with suppliers and finally the findings of our investigation of external reports of successful functional procurement will be presented. The aim is to build an empirical base, which could then be compared and analyzed with the literature review presented earlier. This analysis and comparison will be made in the next chapter.

4.1 Technical research institute of Sweden AB and its current situation

SP Technical research institute of Sweden AB (SP) is a Swedish government owned research institute and is currently one of the largest in Sweden. SP is a parenting company to six subsidiary companies. The corporate group goes under the RISE holding AB, which works as a common brand for the Swedish institute sector. The headquarter of SP is situated in Borås and has several offices around the country.

The activities at SP aim to build a strong base of knowledge and capabilities in close cooperation with small and large companies, universities, other research institutes and international partners. As an attempt to strengthen the competitiveness and contribute to sustainable development in Europe, SP has joined the Ecopol project. Ecopol is a multinational public partnership that aims to accelerate eco-innovation policies across Europe as an instrument to stimulate the growth of eco-innovations. The main focus in the Ecopol project is Green Public Procurement, which is the action of procuring energy efficient and environmentally friendly products by setting sustainability requirement on suppliers. (Ecopol, 2012)

Employees	~ 1100
Turnover	900 Mkr
Ownership structure	Owned by RISE Holding AB, and by the Swedish government
Activities	R&D, testing, evaluation and development of technique, products and processes

Table 2 Key facts about SP (SP[2] and RISE[3], 2011)

[2] RISE, 2011: http://www.ri.se/forskningsinstitut/sp-sveriges-tekniska-forskningsinstitut

4.2 Public procurers

The results presented in this section are based on six semi-structured telephone interviews with public procurers in the Gothenburg region. The interviews took place between the dates 2012-02-27 and 2012-04-15. Each interview lasted roughly between 15 and 45 minutes. Depending on the type and structure of the company, people with different titles and roles have been interviewed. Some companies have referred us to speak with the CEO, whereas some have referred us to the head of procurement or similar. The following companies/institutions were interviewed:

- Familjebostäder i Göteborg AB
- Göteborgs stads upphandlingar AB
- Göteborgs Egnahems AB
- Higabgruppen
- Försäkrings AB Göta Lejon
- Göteborgs Hamn AB

4.2.1 Public procurers and functional description and procurement

In general, one can say that the vast majority of the interviewees know about functional procurement as a concept. In a minority of cases, the concept as such was not known by that name, but rather as "technical procurement" which is another term that is related to public procurement used in the past, but not identical. For example, the law of public procurement does not cover it, but it is organized by public entity in order to catalyze the market to develop and improve their solutions. In this case functional descriptions was mostly used.

Having understood what functional description and functional procurement is however not the same thing as actually using and implementing it, when performing procurements. Our findings are, that despite having knowledge of functional procurement and its benefits, it is not frequently used. None of the respondents could state how often they used functional descriptions in their requirements specifications.

[3] SP, 2011: http://www.sp.se/sv/about/information/Sidor/about.aspx

The reasons for not using functional requirement specifications (or using it more often) has varied between the respondents, and these have been categorized into three main reasons.

- It is believed to be relatively more complicated (two out of six)
- It is difficult to define their need as specific as necessary, while at the same time being general enough to call it functional requirement specification (one out of six)
- They simply do not know why they are not using it (three out of six)

There are, however, a few cases when the respondents have used functional procurement. One example that was mentioned by one of the respondents, P4, was when ordering a kiosk to be built. Instead of specifying exactly how it should be built and the exact characteristics of the kiosk, a more general functional description of the kiosk was given. It could be questioned if this was really a functional procurement by our definition, would for example a set of automatic vending machines be considered by the procurer? However, according to the procurer, it was by their definition a functional procurement.

One case that was clearly a functional procurement was mentioned by one of the respondents, P3. It was when they procured cleaning for their buildings. They did not explicitly say how the cleaning should be performed, but rather that it should be cleaned once a week. The end result should be a clean building, and it was up to the suppliers participating the procurement to decide what exactly to include in the cleaning. According to the procurer, this has worked well in the past.

4.2.2 Public procurers and an implicit exclusion of smaller or newer suppliers

A majority of the respondents have not thought of their procurements as something that would exclude anyone. When confronted with the question, a majority continued to state that they did not exclude small and/or new suppliers in their procurements. The general opinion has been that since the procurement is publicly announced and available to all possible suppliers, and that they put the same requirement on all actors, they did not exclude anyone. However, one respondent, P4, stated that the size of the supplier would mostly correspond to the size of the purchase; that small suppliers are limited by

their size and cannot supply goods / services on a larger scale and they are therefore "automatically" excluded since they cannot fulfill the requirements of being able to deliver a certain amount in a certain period of time. This was seen as something natural and not a deliberate strategy to exclude someone.

4.2.3 Public procurers and sustainable development/requirements

Although many respondents acknowledge the importance of sustainable development, and thus requirements thereof when it comes to procurement, it is not as frequently used as one could expect. The general mindset when it comes to sustainable development is that it is important; however, when it comes down to actually implement it themselves, it becomes less of a priority.

One respondent, P4, which several times has been considering sustainable development in the procurement phase gave a very interesting insight. They have several times referred to and required the ISO 14001 (a standard framework for developing and maintaining management systems for improving the environmental performance of products and services) when specifying the requirements of the procurement, but also stated that this requirement is a very demanding requirement. Especially for smaller firms which are usually not certified or complying with this standard because of complexity and price reasons. The respondent therefore does not require this when it comes to smaller procurements in order to not exclude smaller or local firms. This example is also interesting for the previous question regarding (implicit) exclusion of suppliers.

4.2.4 Co-developing of products and services

Only a few of the respondents were aware that they were allowed to develop a solution in close cooperation with a potential supplier, and then make a procurement of what was developed from the supplier. As long as other possible suppliers are not excluded or that the requirement specification does makes it impossible for other suppliers to participate and potentially be selected as a supplier, the procurer can co-develop a solution with a supplier if they want to. One example of co-development of a solution is related to the problem with resonance in the Ullevi Stadium construction. A very broad functional description of the need was specified, namely a solution of removing and/or reducing the resonance problem. With this specification, the owners of the structure worked in cooperation with a potential supplier, which was basically free to do whatever they

wanted, as long as the resonance problem was removed. This is an important fact, as this problem is very unique as there is only one stadium which is constructed the way Ullevi is. It was therefore hardly, or even impossible, to specify how to solve it in a technical requirement specification. As the supplier did measurements and developed a solution to reduce the resonance, the owner of the construction could then procure this solution while at the same time comply with the LOU since everyone was allowed supply a solution to the resonance problem (although there was only one that had a solution, the supplier which they have worked in cooperation with).

4.2.5 The connection and communication between procurers and suppliers

The main means of communication between the suppliers on the market and the public procurers is through the procurement itself (i.e. through announcing the need, requesting and evaluating quotes etc.).

One respondent used a website where suppliers could register their products (in this case, in-door paint) in the web portal and also specify the different characteristics of the paint, which chemicals it contains, and what the price of the product is. The company could then not only select the best paint using a database of different sorts of paint, but also get an overview of what different types of paint that is currently available on the market. Another respondent used a board of experts within the field to get an overview of what types of solutions and what suppliers were available on the market. In this way, they were able to see new trends and also increase the chances of finding a new innovative solution.

All of the procurers think the current way of communicating is enough and serves its purpose well. They are in general less interested in increasing and/or extending the communication with the suppliers due to added work and increasing complexity. One respondent told us that this reluctance of communication was, in their case, the fault of the "system" of public procurement; that suppliers and procurers are not supposed to communicate and have a too tight relationship, as this could potentially disfavor other suppliers. The respondent further argued that having a relationship with one or more suppliers can make the decision of which supplier to select more difficult as it is more difficult to say no to someone you have a relationship with, and it will also be possible for the suppliers not selected by the procurer to try to appeal the decision with the

argument that the supplier was selected on a friendship basis rather than the one having the best offering.

Key findings
The public procurers mainly go for the cheapest products (and services) that is available on the market
The public procurers do not see themselves as promoters of innovations
The public procurers do not use functional requirement specification since they believe it is more complex than technical description
The public procurers do not co-develop with suppliers if they don't need to

Table 3 Key findings from interviews with public procurers

4.3 Suppliers

The results presented in this section are based on five semi-structured telephone interviews with suppliers that have been involved in procurement of innovation. The interviews took place between the dates 2012-04-11 and 2012-05-08. This list of suppliers comes from the list of companies that have been involved in procurements from the report by the Swedish Energy Agency (2006). These procurements were requesting higher needs than what was available on the market at the time, and had the aim of promoting innovations towards sustainability. This is of interest since this is the type of companies that has shown an interest in developing product that currently does not exist on the market. The following companies were interviewed:

- Blueair AB
- Energi & Miljöteknik AB
- Lagerstedt o Krantz AB
- Novotek AB
- Uponor AB

4.3.1 The involvement in public procurement

A minority, two out of five suppliers, stated that they have been involved in public procurement themselves. Additionally, one supplier (S1) stated that they have been involved public procurements, but only in an indirect manner. In this case, a contractor was the one that were actually performing and being responsible for the supply side of

the procurement, and this contractor in turn used products from the interviewed supplier. In other words, the supplier was delivering products as sub-components to a larger public procurement through a contractor, which means that the transaction between the interviewed supplier and the contractor was not a public procurement. One respondent, S5 states that their main type of customer is the industry, and that is what they focus on, not public procurements.

4.3.2 Co-developing of solutions with PP's, to what extent is it conducted?

In the cases where the supplier has not been involved in a public procurement, the question whether or not the solution was developed together with the procurer is not valid (S1, S4, S5). In the other cases where the supplier has been involved in a public procurement, none of these stated that the product was developed together with the public procurer. However, in several cases, two out of five to be more exact, the solution delivered to the public procurer in the end was in fact unique and custom made. In all those cases, the nature of the solution is one of modularity where a custom made solution is constructed out of several existing components. For example, the exact way a plumbing solution looks like is unique to every building or construction, but its constituent parts are entirely based on a set of standardized components such as pipes of different dimensions, connectors of various kinds and valves for different purposes. In the terms of this report and its definition of innovation, the procurement of these customized solutions with the help of pre-existing modular parts is not considered as procurement of innovation.

4.3.3 The awareness of the possibility of developing solutions together with a public procurer

When it comes to the awareness of the possibility of developing solutions together with a public procurer, the respondents can roughly be divided into three groups; 1) those who knew and were aware of the fact that it was possible, 2) those that were not aware of the fact, but after being informed it is in fact possible, they could easily understand and accept it, and finally 3) those that hesitated and/or came with counter-arguments such as they thought this was against the principle of public procurement.

Although a set of suppliers knew about the possibility to co-develop with a public procurer that is not to say that they were actually doing it as the results of the previous question shows. Respondent S3, who has participated in public procurements, states that

they know they are allowed to, but that they could already deliver customized solutions based on their current set of components and that they don't perceive the need to develop new component which will only be used with one customer, once.

The second set of respondents (S1, S2, S5) either explicitly admits that they did not know it was possible, or implicitly by saying that they have not reflected on the matter. Respondent S5 avoids to answer the question in a direct manner, but states that it is *"currently not interesting"* for them to participate in the situation of developing a solution together with a public procurer, as they are focusing on the industry where the law of public procurement is not applicable. Respondent S2 also share this perception; as they have not participated in such situations, and are not planning to, they have not reflected whether it is juridically possible or not. However, respondent S2 adds that it spontaneously sounds like it is counter-intuitive to principles of public procurement. Respondent S1 states that they are usually not in contact with the end consumer of their products, but via contractors, and did not know the fact that it was possible to develop a solution together with a supplier.

In the third set of respondents, those that hesitated and/or came with counter-arguments or questioned the fact that suppliers *are* allowed to develop solutions together with a public procurer; a few general "ideas" were given. One respondent, respondent S4, stated that he was not a juridical expert, and asked questions like *"If you develop something together with a public procurer, when does this transcend to the [illegal] act of giving one specific supplier an unfair advantage?"*. A general unawareness of exactly at what point in the procurement process that the regulations of public procurement kicks in, if you are allowed to develop a solution with a particular supplier but at the same time not giving an unfair advantage to that supplier later on in the process.

4.3.4 Developing solutions together with other types of customers

The response to whether a supplier has been developing a product together with a procurer (other than a public one), yielded roughly the same results as was presented in section 4.2.2, where the question specifically addressed public procurement.

The principal response is that the company always tries to offer good solutions to their customers, and that they are continuously trying to improve their arsenal of products to

meet market demand. However, when it comes to developing a product specifically for the sole purpose of one customer, the answer is no. Respondent S1 is an exception, where they claim to have developed a new product at the request from one of its customers. On the other hand, the new product was of similar type and characteristics as their existing assortment, merely with a different physical dimension, and they expected the product to be saleable even to other customers in the future and introducing it into their main range of products. Respondent S3 has a similar reasoning, where they say that developing a new product for one specific customer will be very expensive if it *"does not concern a very large purchase"* and something that they have not done so far. However they would possibly do so anyway if they believe it has a potential to become profitable, by for example being able to extend their product range and selling the product to other customers in the future. S3 further argues that if such an event would occur, it will not only benefit that specific customer but also other customers and also proves a good opportunity for the company to gain a competitive advantage.

Respondent S2 and S3 states, that due to the nature of their solutions, they are practically always specific to every customer as every case is unique. However, this has been concluded to not being equal to actually developing the physical products, but rather combining existing products in unique ways.

Respondent S4 gives a slightly different explanation. What they offer is not simply a product; in relation to a purchase of their product, investigations, measurements and calculations are made to provide the customer with data such as energy savings by using the company's product. Since such conditions that are measured are unique, their offering could be seen as always unique. There is no general "best solution" that works in all cases, he supplements. Respondent S5 has a similar situation to S4. Their product itself is not developed in cooperation with the customers, but local adaptation is almost always needed to connect their system to the customers' current facilities.

4.3.5 Co-develop with a public procurer, despite no guarantee of getting the deal

This question is related to the fact that a development together with a public procurer does not automatically mean that they will be able to sell the developed solutions to them as everyone, including their competitors, should have an equal chance to compete

in the procurement process. Most respondents say, somewhat surprisingly, that they would, but only with certain conditions and circumstances.

Respondent S4 gives an interesting insight; that, despite the fact that other competitors have the chance to get the contract with a public procurer, their company would still be more likely to get it since their solution would have been developed together with the public procurer and their company's solution would therefore match the procurers specifications better than the competitors. However, S4 concludes, that it would be tough and disappointing if they in fact would develop something together with a public procurer, and not get the deal in the end. But this fact is not unique to public procurers, but to all types of customers.

Respondent S2 states that they, in principle, could think of developing a solution together with a public procurer. However, the risk of not getting the deal in the end is believed to be large enough to make them refrain from doing so. This is because they could not stipulate the delivery in a contract, which they otherwise could if the procurer was not regulated by the law of public procurement, and he refers back to the information given in the question that they were not guaranteed to be chosen as a supplier even though they have developed a solution together with the public procurer.

Respondent S1 have a different opinion. They state that whether or not to participate in such a co-development that was mentioned in the question largely depends on the attractiveness of the deal. If the development was financed, at least partly, by the public procurer, this would give them a relative advantage over their competitor as they could develop new solutions cheaper than their competitors would. However, this must be done with the premise that the developed solution would lead to an improved product of which could be sold to other customers, current and new, and thus improve their market position.

S5 agrees with most of the reasoning of S2 and S4, but also gives two distinct answers depending on what type of development that is referred to. If it is development which could be considered as minor product improvement of existing products, or merely new types of configurations based on their current set of products, the answer is that they

might be interested. However, if it involves developing entirely new products, it would be considered as too risky and expensive and thus they would not do that.

4.3.6 Communication outside the public procurement process

The flow of information: what information is sent by whom and at what time, is regulated by the law of public procurement. A way of circumvent this is to communicate outside this process, for example announcing intentions early on and expressing general needs at for example conferences. This question deals with whether or not the interviewed companies have taken part of such information, and if it has lead to development of products.

Most respondents, three out of five, state that they have not received such information from public procurers. Respondents S2 and S3 say that they have been taking part of such information, but from procurers in general and not public procurers.

4.3.7 What ways the suppliers would like to be informed of public procurers needs

This question has proved to be difficult for the interviewees to answer. They give examples such as public procurers' homepages in the case such exist, seminars of various kinds and national fares specific to their respective industry. However, as respondent S2 notes, they do not have the ability and/or resources to participate in all such fares nor being able to continuously survey the homepages of all possible public procurers of interest. S2 further argues that a dream scenario would be if public procurers could contact the leading companies within the certain industry of interest well in advance and state their intent or interest of procuring this and that type of product. But, on the other hand, S2 realizes that this could be time consuming and resource heavy for the procurers.

Respondent S4 hesitates and complain that, even though it would be interesting for them to know about the procurers' intentions well in advance, it would be time consuming for them (the company S4) to browse through public procurers homepages in search for public procurers that announces their intent early on.

One respondent, S1, states that since public procurers are not their customers in a direct manner, but rather indirectly through contractors. It is therefore of less importance to them in what ways the public procurers expresses their needs, or at what point in time this is done. If such information is communicated, the respondent would prefer if it would be propagated through the contractors, as this is the normal route the needs and requirement specifications flows.

Another respondent, S3, not only gathers information from procurers of various kind through industry fares, but also observe their competitors at such occasions. It is a great opportunity to see the latest and cutting edge solutions provided by our competitors, and a way to see in what way the industry is heading in terms of development. The principle of surveying the market in terms of what is offered by competitors is also acknowledged by several other respondents.

4.3.8 Incentives to participate in public procurements

The question of whether introducing different types of incentive systems to inspire and drive companies to participate in public procurement yielded several interesting viewpoints. They can be grouped into three groups. The first group (consisting only of S4) is one with solutions comprising both physical products as well as services such as analysis and evaluation of configuration alternatives. They could definitely see the benefit of receiving some kind of standardized compensation for the cost of doing the above-mentioned evaluation. This group of companies thinks it would benefit the industry and also inspire especially smaller firms to participate in public procurements.

The second group of companies (S1, S5) is not sure about how different types of incentives would affect them. Basically, it depends on how the actual implementation of these incentives would look like, and what amount / value of the compensation that comes up. One participant of this group states that some form of compensation would be good, and probably result in an increased number of participants participating in public procurements, which in turn probably would lead to increased competition; something that at least should be interesting from the procurers point of view.

The third group (consisting only of S2) is also positive to some kind of compensation at a general level, but the nature of their business is not of the type mentioned in the first group.

One respondent comes with a very interesting view on the matter. An incentive to participate in public procurements, especially if it is through monetary forms, could potentially pave the way for less serious actors. A small actor could have participating in public procurements and receive "incentives" as their main business model, and never plan on actually developing or delivering a solution and thus reduce their costs to almost nothing. If monetary incentives are introduced, there must be some kind of defense mechanism against this type of behavior.

To conclude, generally interested to participate in public procurements if there would be incentives to do so, but the decision is very dependent on actual implementation of the incentive system.

4.3.9 The risk of exposing innovative products

By participating in a public procurement, the quotes that are sent in by the suppliers also become available to potential competitors and other actors on the market. By having a novel idea or solution and you specify it in a public procurement, there could be a risk that other companies get to know the idea early on, potentially before it is out on the market. When this matter was discussed with the respondents, this potential problem was generally not seen as so severe that it would refrain them from participate with such a product in a public procurement. As respondent S4 sees it, there are two constituent parts of an offering; products and services. Products, should they been novel, could be patented and thus reduce the problem of being copied by competitors. Services cannot be patented, but they are on the other hand not easily copied either. Other aspects that play an important role, such as know-how, will not be a part of the quote, and thus further complicates copying. Another respondent (S5) gives an example of a (computer) solution consisting both software and hardware. Suppose they participate in a public procurement and fulfills the requirements of the procurer, this is specified by the functions that the software can handle and the hardware decides the performance of such solution. In the specifications given by the supplier, exactly how the software handles the specified functions (e.g. the source code of the software) is not supplied. The hardware is usually based on off-the-shelf components and possible to reverse engineer, where the software is not. If the hardware is more complicated and novel, it could possibly be protected by patents

One respondent, S2, perceives this risk to be of less importance; if copying is possible, copying a product can be done anyway irrespectively if you participate in a public procurement or not. The minute a products enter the market, potential competitors could see the product. The response of respondent S1 matches the one of S2, and adds that all their products are available on their homepage anyway, available to virtually everyone.

4.3.10 Evaluating the quotes by lowest LC cost

Many of the respondents, four out of five (S1, S2, S3, S4), are companies that offer solutions that could potentially lower the cost in the long run by saving energy, for example heating and ventilation. In these cases, the potential savings in the long run far exceeds the cost of the product and installation of it, according to the respondents. All companies in this set see evaluating of the quotes by taking the life cycle cost into account a necessity. One respondent, S4, states that approximately 10% of the cost originates from the cost of the product and configuration of it, whereas 90% of the cost originates from the energy and maintenance cost of it. A little increase of cost by either fine-tuning the existing system or purchasing a slightly more expensive product could potentially yield great savings in the end. Therefore, not taking these 90% into account when evaluating the quotes would yield very misleading results that would not benefit the procurer. Respondent S2 agrees with this point of view, the upfront cost is one thing, and the cost of replacing vital parts once they have been worn out is another (as important, or even more important) thing. Another respondent (S3) also agrees that lowering the energy consumption is important for today's products, but also adds that one thing that is often overlooked is the working environment of the workers doing the installation. The installation should be both easy, and also reduce hazardous risks for the workers by for example use less toxic materials, allowing the workers to work with much less protection equipment, if any at all. Putting a physical value on things such as working environment and long-term health aspects is however difficult and they acknowledge the fact that this would be impractical or even impossible to specify in a public procurement.

Respondent S5 acknowledge that there is a current trend towards lowering the total cost during the entire life cycle, rather than the upfront cost of the purchase. Although not being of the type of supplier mentioned in the previous paragraph, they also see the benefit of being evaluated by the lowest life cycle cost.

Key findings
None of the suppliers had co-developed anything with a public procurer
The majority of the suppliers did not know that it was possible to co-develop with a public procurer
None of the suppliers believed that the publicity of their products (and/or services) was a problem, as they were either protected by patents or were based on know-how

Table 4 Key findings from interviews with suppliers

4.4 Cases of procurement of innovations

The public documents that were used in this study have contributed to the collection of secondary data to this report. The Swedish Energy Agency (Energimyndigheten) has published a report *"Energimyndighetens Teknikupphandlingar"* (The Swedish Energy Agency, 2006), containing a list of 55 cases, related to procurements of innovation during the period between 1990-2005. The report provides several cases of successful procurement of innovation, through what they refer to as *technical procurement* (Teknikupphandling). However, there are also cases where it is unclear if whether the goals were achieved or not. Technical procurement is defined by the Swedish Energy Agency (2006) as a way to promote the development of new techniques. Five main examples are presented in the report where they, the Swedish Energy Agency, have worked as a catalyzer of procurements of new and innovative products and services. A more thorough description of these examples will be explained in this section.

Procurements in general can stimulate and diffuse innovation in both direct and indirect ways. Direct ways would for example be to move forward the introduction of the products and services, move forward the use of them, and quicken the acceptance of them (Swedish Energy Agency, 2006, p.7). Indirect or secondary effects, perhaps of equal or greater importance, could for example be changed industry standards, increased knowledge, and increased communication and interaction between the actors (Swedish Energy Agency, 2006, p.7). This can be seen as a knowledge spillover effect, where the information attained in the development was transferred (spilled over) to other segments. One example where these secondary effects is highly visible is when the

Swedish Energy Agency procured energy efficient fridges and freezers, which is described later in this section.

4.4.1 Energy efficient windows

The aim with this project was to stimulate window manufacturers to develop more energy efficient windows.

This case on energy efficient windows shows an example where procurement succeeded in generating not only the products specified in the requirement specification, but also generated the secondary effect of a changed industry standard is the case of energy efficient windows. Although the direct effects of this procurement was relatively small when it comes to market share, the following measures to diffuse the technology in the market led to a shift in the industry towards more energy efficient windows (Swedish Energy Agency, 2006, p.8). The direct effects of the procurement led to a market introduction of windows with a 45% decrease of heat loss compared to the windows currently offered in the market, which can be considered to be very successful procurement. At first, the requirements specified by the procurer was set to a maximum heat loss of 0,9 W/m2°C, which resulted in solutions with four layers of glass. Due to several factors, this requirement was eventually considered to a bit too ambitious, and was changed to 1.0 W/m2°C, which resulted in solutions with only three layers of glass (Swedish Energy Agency, 2006, pp. 9-10).

4.4.2 Refrigerators/freezers

The refrigerators/freezers project strived to decrease the usage of electricity to half of what it was at the time. This was aimed to be achieved by stimulating suppliers to develop products that are more energy efficient.

As stated before, this case of refrigerators/freezers shows a good example of the indirect effects that procurement of innovation can generate. In the procurement, only one type of fridges/freezers was requested. However, as suppliers eventually developed this type of fridges/freezers that met the requirements (a direct effect), this knowledge and technology was also transferred into other types of fridges/freezers that were not requested in the mentioned procurement, and the industry standard changed, which is a good example of an indirect effect. (Swedish Energy Agency, 2006, pp.10-11)

4.4.3 Air handling units

The purpose of this project was to stimulate the development of air handling units, in terms of lower the usage of energy (heat and electric) and better functionality.

The technical procurement of air handling units is another case where the indirect effects of procurement of innovation are clearly visible. The procurement strived for achieving better utilization of energy, electricity in particular. However, the requirements for this project were not attained until after the procurement. The Swedish Energy Agency (2006) argues that this failure in meeting the requirements depended on that the specifications were too concentrated on unit size instead of on a series of sizes. After the procurement, a series of ventilation units meeting the procurement specifications were developed, which further pushed the market standards towards increased energy efficiency. (Swedish Energy Agency, 2006)

4.4.4 Small solar heat systems

The project aimed at developing solar heat systems through a better organized customer management, as an attempt to accelerate the development of the solar heat market. The project also strived after a better relation between price and performance as well as a better way of installing the system.

The solar heat systems case have had many direct effects such as development of technique, and indirect effects, in terms of increased usage of solar heat systems. The increased number of installations of solar heat systems has had significance for the solar heat system market to become considerably larger, and move from being a handcraft manufactured product towards manufacturing it industrially.

The project initially started as a procurement process where small homeowners were the target group. However, as the target group was considered to be too small, the project had to take new directions. The technical procurement was instead turned into a technical competition and the project now included a pre-study, interest groups, bidding procedures, evaluation and information activities, among other things. According to the Swedish Energy Agency (2006), the project was successful mainly due to two factors. Firstly, the industry was successful to reduce the investment costs of the solar heat systems with about 25-30 percent, and secondly as the installation of the system was simplified. (Swedish Energy Agency, 2006)

4.4.5 Water taps

This project had the purpose of stimulating the manufacturers to develop new resource efficient water taps and to influence the major part of the market to choose more efficient products.

The technical procurement of water taps was carried out in cooperation between the Swedish Energy Agency and the city of Stockholm's local chancellery of the investment program, LIP. This project was somewhat different from the other cases of technical procurements as in this case there was only one single bidder present. Although the bid was of high quality, in terms of attaining the majority of the procurement requirements, it resulted in that no comparison with other contributors could be done. This project on water taps did not result in any direct effects when it comes to new development of techniques. However, it had indirect effects on the industry by contributing to better utilization of energy and diffusion of energy efficient techniques, which is approximately 40 percent lower than the formerly dominating products on the market. (Swedish Energy Agency, 2006)

To summarize the findings from the case studies, a table has been created that serves to give a quick overview of these cases (see *Table 5*). It shows both the type of effects (i.e. direct and/or indirect), and also what the effect was.

Key findings		
Case	**Type of effects**	**Effects**
Energy efficient windows	*Direct (small) and indirect effects*	Better utilization of energy (45% decrease in heat loss)
Refrigerators/freezers	*Direct and indirect effects*	Better utilization of energy (electricity in particular)
Air handling units	*Indirect effects*	Better utilization of energy
Small solar heat systems	*Direct and indirect effects*	Reduction of investment costs for the product Introduction of the product to a larger market Simplified installation of the system
Water taps	*Indirect effects*	Better utilization of energy (40% lower energy consumption) Increased diffusion of energy efficient techniques

Table 5 Key findings from five cases given by the Swedish Energy Agency (2006)

4.5 Public procurement of innovations - a driver for future health in Europe

A very interesting conference on PPI (public procurement of innovation) took place in Stockholm, October 13 2009. The title of the conference was Public procurement of innovations - a driver for future health in Europe. Some of the highlights and most interesting facts have been summarized in a document by Vinnova, Swedish Governmental Agency for Innovation Systems.

In the conference, good practices of PPI in the United Kingdom were brought up. One of the participants, Jaroslav Kracún from DG Internal Market and Services, confirms the statements made by Rothwell (1984), namely that: "*Instead of stating technical specifications and standards, procurers should describe performance and functional requirements"* (Vinnova, 2009, p.1). Karcún further argues that "*They [procurers] should also consider the economically most advantageous tender, judging quality and lifetime costs instead of lowest price*" (brackets added) (Vinnova, 2009, p.1)
Charlotte Brogren, Director General at VINNOVA (Sweden's Innovation Agency) in 2009, stated that "*PPI could be a powerful driver for innovation from the demand side*". A study by Copenhagen Economics, having studied several examples of procured innovation, concludes that "*PPI requires a dialog with the stakeholders for understanding societal needs and formulating specifications in a way that stimulates innovation and preserves competition*". Furthermore, Marieke van Putten from The Ministry of Economic Affairs in the Netherlands has concluded that "*promoting PPI must include giving public procurers other tools than in ordinary procurement. There the objective is only to follow rules, but buying innovations requires an organisation that develops market knowledge and multidisciplinary collaboration.*" (Vinnova, 2009, p.1)

The conference focused on innovation in the healthcare industry, and a study of the innovation system and healthcare in the United Kingdom was presented. They claim that, despite absence of a large set good examples; there are still a few that has proved successful. The healthcare industry is one of them, and it is continuously in need of improvement and development in a rapid pace to keep up with new medical threats. However, at the same time, one has to be careful since mistakes in this industry literally are a matter of life and death. Therefore, the industry is heavily regulated and introductions of new solutions are a time-consuming process. Once an innovation is

approved and adopted, its technology is likely to have a few years of market and therefore can be classified as a late adoption. The example is taken from the United Kingdom National Health Service (NHS). The NHS claimed to have gone from talking to action. The United Kingdom government states that PPI is *"critical for meeting the current challenges in society"*, and the Purchasing and Supply Agency, responsible for purchasing for National Health Service, is claimed to have played an important role to challenge the industry to innovate in situations where a solution was not readily available in the market. Additionally, the National Health Service has gone one step further to promote innovation by establishing National Innovation Centre which has "identifying technological needs and speed up the development with pre-commercial procurement" as their responsibility. They do so by for example having several web-based tools, which also ensures transparency. (Vinnova, 2009, p.1)

The overarching conclusion of this conference was that *"Public procurers can drive innovation by acting as technologically demanding first buyers of innovations in the healthcare sector"* (Vinnova, 2009, p.1) and, a top-down decision made by the government made this possible.

Key findings
"PPI could be a powerful driver for innovation from the demand side" (Charlotte Brogren, Director General at VINNOVA (Sweden's Innovation Agency) in 2009)
Instead of technical specifications and standards, functional requirements were used
Healthcare industry is a heavily regulated industry. If promoting innovation works there, it should be possible to work in other industries as well

Table 6 Key findings from the United Kingdom case

5 - Analysis

In the previous chapter, the empirical findings were presented. In this chapter, these empirical findings are analyzed by connecting them to and applying the literature review presented in chapter two in order to address the research questions. This chapter thus includes a thorough analysis of the public procurement process, through the perspectives of public procurers and suppliers, the implications these have on innovation and also the role of public procurers in the innovation system. In this chapter each research question is addressed separately.

5.1 What role do public procurers have as customers towards the promotion of innovation?

The analysis of the first research question is based on the data collected by interviews of public procurers. This data was presented in section 4.1. This first research question has been subdivided into two sub questions; *"What customer type are public procurers?"* and *"Does public procurers, and if so how, act as lead user?"*.

5.1.1 What customer type are public procurers?

The characteristics of public procurers, in terms of to what extent they are acting as promoters of innovation and how willing they are to act as a lead user, is interesting to understand. This brings us to the question whether it lies in the interest of public procurers to act as promoters of innovation and a lead user, or not. Based on Roger's (1962) adoption/diffusion curve, if public procurers are acting as an early adopter, it could indicate that they have the interest to be a promoter of innovation and become a lead user. While this interest might be somewhat low when it comes to late majority, and especially when it comes to laggards.

The classification system, provided by Roger (1962), consisted of two main types of adopters; those who were in the early stages, and those in the later stages of the innovation diffusion. If looking at the key findings from the interviews, it is visible that public procurers are willing to purchase a product or service in its early phases and this is according to Roger (1962) a main characteristic for an early adopter. He also emphasizes that early adopters are always in the front row of purchasing an innovation, even though it is underdeveloped and often also expensive. In the case of public procurers, findings from the interviews however also show that other factors than being first to adopt the innovation has more importance. Price is one such factor that has been

identified. Public procurement, as it is today, mainly goes for the cheapest product or service that is out on the market. This act of choosing the cheapest product is a characteristic that could fit the customer types that are early majority and those who are in the later stages of the innovation, such as late majority and laggards, rather than early adopters. Laggards, on the other hand, are too skeptic to purchasing an innovation before it has been adopted by the majority and become mainstream, which is not a characteristic that features the public procurers based on the interviews.

As indirectly stated above, at the current stage, public procurers do not work as a driver of innovation but at the same time they could think of trying new ideas. This is a characteristic that matches those for the early majority, which was explained more thoroughly in section 2.5.2. This is also strengthened by Roger (1962), highlighting that early majority does in fact accept some change, and they do so more quickly than the average adopter, but they will not, as the very early adopters, pull for change.

At the same time, all public procurers do not act the same. There is for instance a difference between the healthcare sector and the service and administration sector, in terms of how rapid and fast the development of innovation is and so on. In the healthcare industry, many of the techniques and products must be tested before it can be put to use since it is a matter of saving lives and at the same time not to cause harm. This way of acting has similarities with the characteristics of late majority. Late majority, according to Roger (1962) are more skeptic and would rather wait until the innovation has been adopted by the majority of the people and used for a while. Being a late majority would denote that it is difficult for the public procurers to co-develop products and services together with suppliers, as they lack in interest to do so. This seems also to be the case, according to the responding public procurers, that the interest in developing solutions together with a supplier seemed to be relatively low, as they did not have any incentives to do so.

So far, it has been identified that the characteristics of the public procurers currently, on a general level does not match those for innovators, early adopters and laggards. On the other hand, as stated above, it is hard to place public procurers as one specific type of customer since what type of customers that public procurers are can be affected by the type of industry that they exist in. With this in mind, what can be stated so far is that the

characteristics of public procurers best matches the characteristics of the early majority and late majority, which corresponds the interval between these two, as can be seen in the color red in *Figure 8*.

However, this does not mean that public procurers cannot take on the role as an early adopter. The conference from Great Britain strengthens this, by indicating that public procurers can stimulate innovations by being an early adopter and providing specifications in functional terms and act as a risk taker. The conference further shows that, even in an industry such as healthcare, where the products needs to be well tested, procuring products and services in its early stage is a method that works excellently. This is also emphasized by Rothwell (1984) to be an efficient strategic act by governments to potentially stimulate and diffuse innovations.

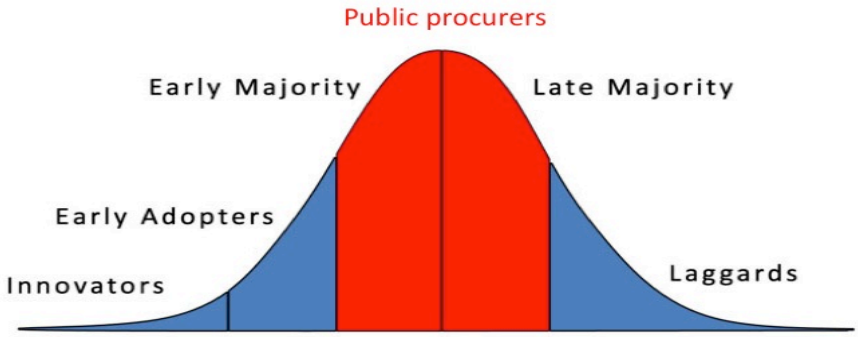

Figure 8 Public procurers classified as early and late majority in Rogers (1962) innovation adoption/diffusion curve. Adapted from Rogers (1962)

Public procurers could act as promoters of innovation by gradually moving towards taking on the role as an early adopter, but as the findings from the interviews and theories denote, this is nothing that comes automatically. Public procurers pointed out that they have knowledge about functional description and the benefits of it, which indicates that starting to use this method could be a first step towards becoming a lead user. The impact that procurement can have on driving major (radical) technological changes is stated by Rothwell (1984) to be higher in the early stages of the product and industry cycle of development. Once the market matures, the improvements will be more incremental rather than radical changes (Rothwell, 1984), which also seem to be the case for the public procurers that were interviewed.

By moving towards taking on the role as early adopter, the public procurer can help new and innovative solutions cross the so called chasm, which was introduced in section

2.5.2, by providing an initial market and also help the solution to gain acceptance on the market by giving it legitimacy. By doing so, they help the innovation to reach the later stages of the innovation adoption curve and thus diffuse it to a wider range of customers, which should be in the interest of the society at large.

5.1.2 Do public procurers, and if so how, act as lead user?

Public procurers do not presently lie in the front row of helping suppliers by acting as lead users. Based on the interviews with both public procurers and suppliers as presented in section 4.2 and 4.3, characteristics of lead users were not found to be present for the public procurers. In section 2.5.1, several criteria were mentioned that needed to be fulfilled by the public procurers in order to be categorized as a lead user. One of them was that a lead user is one *"whose present strong needs will become general in a market-place months or years in the future"*. The needs of the public procurers interviewed have rather been identified as constant in terms of time. That is, what their current need is, is what it has been since a long time ago and the procurement of such can be signified as business as usual. Cases of procurements that was not business as usual, was the case of the resonance dampening in the Ullevi stadium. In that case, the need and consequently the procurement were new and nothing similar to business as usual. Although being a strong need, it does still not qualify because it was not a need that was ahead of the general market nor will it likely become general on the market in the future. Though, there is a chance that technology in the solution supplied by the supplier was specifically developed for this procurer, and that this technology can or will be used in the future - but this is far-fetched and practically impossible to tell.

Judging from another criterion for lead users as was also introduced in section 2.5.1; "*they [the lead users] can provide new product concept and design data as well" (brackets added)*. This has certainly not been the case with any of the public procurers, based on the interviews. The suppliers' perspective also confirms this, as none of the ones that had participated in a public procurement stated that the public procurer had provided any suggestions of product concepts or design data. The product concepts and design data most likely originates from the actual user of the solution, as they have more hands-on experience and are more likely to identify flaws in current solutions and possibly have ideas of how to solve them, whereas the procurement department responsible for the creation of requirement specifications and evaluating the received

quotes typically are not the heavy users of the solution. The same argumentation applies to the next criterion in the following paragraph as well.

The final criterion; *"they [the lead user] expect to benefit significantly by obtaining a solution to those needs" (brackets added)*. It is obvious that the public procurers would benefit from procuring a solution that is better compared to one that presumably already exists. If this benefit would be *significant* or not is hard to tell in general, as that would be needed to be evaluated on a case for case basis, and since none of the interviewees could supply an example of this happening it has consequently not been possible to do such an evaluation in this report. One potential hurdle when it comes to innovations whose benefits occurs after a significant amount of time, is that the procuring department of the public procurer is not judged by long-term performance but rather have a budget that they have to stick to. Furthermore, as mentioned in the previous paragraph, the fact that the procuring department most likely is not the end user of what they procure, a risk of sub-optimizing occurs where short-term price is more important than usability and long-term benefits.

Yet, the case of United Kingdom National Health Service as presented in section 4.5 shows that it in fact possible for public agencies to fulfill at least some of the criteria for being a lead user. For example it was claimed to have played an important role to challenge the industry in situations where a solution was not readily available in the market. The first criterion, having needs that will become general in a marketplace months or years in the future is fulfilled as improvements in the healthcare industry will with a very high likelihood propagate throughout the entire healthcare system far beyond the borders of United Kingdom and thus increasing the demand for the new and improved solutions worldwide and consequently the suppliers will follow. Furthermore, the National Health Service whose responsibility is *"identifying technological needs and speed up the development with pre-commercial procurement"* adds to the fact of procuring solutions currently not on the market but will in the future. Whether they fulfilled the second criterion of lead users, providing with product concepts and design data is inconclusive. The users of the solutions are both the customers of the healthcare (i.e. patients), and users such as nurses and doctors. Surely, they have provided a knowledge base and usage data, which the suppliers have taken part of, but whether this is to be considered product concepts, is questionable. The third criterion; the expectation

to benefit significantly by obtaining solutions to their needs; is considered to be fulfilled as the aim of the healthcare system is to keep the population healthy which requires constantly developing of solutions to counter new threats as they come. The benefit of keeping someone healthy and save lives is however immeasurable.

5.2 How does the role of public procurers as promoters of innovation currently look like from an innovation system perspective?

It was introduced in the literature review, section 2.2, that the innovation process works within a system. In this report the focus has been on the collaboration between two main actors; the public procurers and the suppliers. As emphasized by Carlsson et al. (2002), in order to have innovation, both these actors must work in tandem. Their interests and interactions will have great impact on how the development of innovations will turn out and if it will provide an infrastructure that is innovation friendly, or not. The procurement cases provided by the Swedish Energy Agency (2006) shows an excellent example of how the symbiotic interaction between the demand side and suppliers can lead to the outcome of new innovations. The more interesting is that these cases implies that the demand side can direct suppliers innovations in a certain direction by giving requirements that are not too specific in their requirement specification that allows innovativeness, but still stating what they are striving for, which in this case was eco-innovations. This again shows the strengths of using functional requirement specification that is emphasized by Rothwell (1984), which will be looked into deeper in this section. This interaction between the two actors within the system can be viewed from two separate perspectives, as they work simultaneously; one being from the suppliers' perspective and the other from the public procurers' perspective.

From the public procurers perspective, they do not see themselves as having the role as promoters of innovation. Thus, providing an infrastructure that is innovation friendly is not currently of particular interest. Procurement in general, from the perspective of the supplier's, creates a demand on the market. This means that a certain amount of purchase is guaranteed for a given period of time, which is a good reason why public procurement would create incentives for suppliers to innovate.

It was emphasized by Carlsson et al. (2002), that the support and impact from surrounding actors and factors is vital for the innovation process. This supportive action can be seen both in the cases provided by the Swedish Energy Agency (2006) and the

UK case, there was an external actor involved, which created a demand and pushed the supplier innovations in a certain direction. In the case of the Swedish Energy Agency they were asking for energy efficient products and this was also what they got.

There is a risk that, despite the first and second principle of public procurement (i.e. the principle of non-discrimination, and the principle of equal treatment), some suppliers are indirectly discriminated or excluded. If, for example, a public procurer creates requirement specification based on what they have previously procured in a business as usual fashion; suppliers which have a new and innovative solution which solves the actual need, does not necessarily fit the requirement specification. An example of this is, although not investigated in this report but serves its purpose as an illustration; is that a procurer can try to procure the cheapest possible way of transporting its workers to and from meetings or conferences, perhaps also using frequent flyer systems or similar. However, they entirely miss the innovation of video meetings and conferences, which basically solves the same problem, or need both quicker and to a lower price. Therefore, although having a solution to the same need and to a lower price, they do not have the same chance to win a contract with the public procurer since they are implicitly excluded by the too narrow specifications. On the other hand, if the public procurer had expressed their need in functional terms, in this case communication between people at physically separate locations, the supplier of video conferences would have been able to compete with transportation solutions. One example similar to this illustration is taken from one of the interviewed public procurers. They had a website where suppliers could register their products, in this case paint, and the public procurer could then select the paint that best fulfilled the requirements in terms of the different characteristics and cost of the paint. However, what they miss out is solutions where paint is not needed; for example wallpapers in the case of inner walls and other mold resistant and weatherproof materials that do not need paint in the case of outer walls. Although, having some sort of market scanning mechanism, solutions from the entire innovation system is not necessarily found in this scanning. This indicates an implicit exclusion of new and innovative products by the public procurers.

One important link between what was mentioned in the literature presented in section *2.4 - Public procurement of innovation*, and the very successful case of the healthcare industry in the United Kingdom can be seen. One of the roles of the government can be

the role as a "prototype tester" according to the literature. This was explicitly mentioned, *"the most urgent ones [the needs] are turned into competitions for development of ideas and prototypes"* (brackets added) (Vinnova, 2009, p.2). This role has also been mentioned by Kaplan (1999) as presented in chapter 1.1, stating that the government procurers can be used as a testing ground where prototypes can be improved, which will reduce the market risk for innovators.

5.2.1 To what extent is functional requirement specification as a way of facilitating innovation known and adopted?

The literature review of this report explicitly pushes innovations as the main source of growth and underscores the importance of providing incentives to stimulate supplier innovations. Rothwell (1984) suggests strategies for governments to contribute with such incentives to spur innovations, whereas providing the requirements in functional terms is one of them. What is interesting to see is, to what extent functional description is known by the different public agencies and if it is actually adopted, and if not, why is this so?

From the interviews with the public procurers, it was identified that this method of using functional description was known by the majority of the public procurers, however only a few were using it and the majority actually did not know why they were not using it. Expressing the requirements in functional terms, Rothwell (1984) argues, would allow more radical innovations to take place, since it gives room for the solution providers (suppliers) to think outside the box. In contrary to the literature recommendations, since it was believed to be a more complex and difficult method than providing a technical specification, it was not a method that was frequently used by the public procurers. However, expressing it in functional terms should be simpler as it is supposed to specify the function that is asked for. Technical specification on the other hand, requires that the procurers have technical knowledge and capabilities.

Findings from the interviews indicates that incremental innovations is the most frequently occurring among the suppliers, which correlates with the type of innovations that are most often procured by public procurers. According to Kaplan (1999), incremental innovations are crucial for protecting revenues and gaining market share, but for substantial growth in the long horizon, discontinuous (radical) innovations are significant. What current public procurers are doing is that by providing technical

specification, they are in fact excluding suppliers with new solutions, as their technical specification does not match. This indirectly excludes new state-of-the-art goods (and services) and thereby also the incentives for bidders to provide solutions that are more radical in its nature.

Interestingly, despite the fact that most of the public procurers were aware of what functional requirement specifications are, and that they agreed that they would be more innovation friendly; none of them could state how often they used this method of requirement specifications. As has been stated earlier in in the analysis and will also be mentioned in later parts of it; there is a lack of incentives for the public procurers to use functional requirement specifications more frequently.

5.2.2 How does the awareness, and possible even use, of communication outside the regulated procurement process look like, from both the perspective of procurers and suppliers?

For public procurers, the border between legally communicating with suppliers, and having a too close relationship which consequently leads to one or more actors having better chances of winning in a public procurement is blurry. An investigation made by Swedish Government Official Reports (2010) confirms this view by stating that it is fully legal for a public procurer to be innovation friendly, but when it comes to active collaboration with potential suppliers, "some of the possibilities are limited" (Swedish Government Official Reports, 2010, pp. 17-18). The procurement principles stated in LOU allows having a relationship with a potential supplier, but this fact may not interfere in the decision of what supplier to select in the procurement process. The exact meaning of this is less than clear, which obviously leads to uncertainty among the public procurers of what they are allowed to do, and what they are not allowed to do. Interviews conducted with public procurers as presented in section 4.2 confirms this fact, some of them thought it would be strictly illegal whereas some were unsure and only one knew it was allowed.

The need of having relationships with suppliers outside the procurement process was perceived to be low amongst the public procurers. This is to be compared by one of the important capabilities of an innovation system, stressed by Carlsson et al. (2002) and presented in section 2.2. That capability is the ability to acquire core knowledge, data, and competence that are required to develop technologies. Knowledge of what is needed

and usage data of how solutions are used in the end lies in the hands of the public procures, since their interest in sharing this information is low they are therefore inhibiting the maximum potential of the innovation system.

Perhaps the general opinion of suppliers is a result of the current and generally accepted view of public procurers, as the law permits co-operation whereas the procurers don't believe this is possible. One procurer uses a webpage where suppliers can register their products, and in that way get an awareness of what the market has to offer. Other procurers used a board of experts to get insights of the market and where it was heading and thus be able to see new innovations as they come. Although this is one form of scanning the market (and possibly find innovative solutions), the communication is "one-way" as information only goes in to the public procurers but their needs does not come out. Furthermore, this type of market scans can potentially miss radically new solutions. For example, when looking for paint for use on houses, one might be looking into new kinds of paint, but perhaps miss an entirely new type of material that does not need paint and still can endure the Swedish climate.

All of the interviewed public procurers thought that the current way of communicating, i.e. according to the public procurement process described in section 2.3.3, is enough, and in general less interested in extending this communication. One explanation for this point of view would be that public procurers do not have any incentives to communicating more than they currently do, and at the same time (rightfully) sees this as added work. The findings from the interviews with suppliers concur, as most respondents state that they have not received information outside the procurement process. However, at the same time, the suppliers claim to have taken part in industry conferences, seminars and fares, and that information from public procurers' homepages has also been collected at times which could be somewhat contradictory. Other suppliers claim that they do not have the resources to participate in all those fares and to continuously browse through all the homepages of public procurers. Contradictory to this statement is that they as suppliers are responsible to search for and apply with quotes to procurements that is announced by the public procurers, so, they would have to do this browsing anyway. A dream scenario as expressed by one of the suppliers was that they would be contacted by public procurers directly, but could also understand that this would require a lot of resources from the procurer. Yet one more supplier states that

they only have indirect communication with public procurers as they go through intermediate contractors and that would also be the best way of receiving information from the public procurers.

To conclude the analysis of this question, the different actors share the view that extra communication means extra work. The public procurers tends to be satisfied with how it currently works, whereas the suppliers are more positive in receiving information but at the same time have difficulties of explaining how this would work in practice.

5.2.3 How is co-development of solutions perceived from both the procurers' and suppliers' point of view?

Co-development of solutions can be seen from two different views, from the point of the procurers view and from the suppliers' point of view. It was stated by Edqvist et al. (2000) that close collaboration between procurers and suppliers are necessary in effective public procurement of innovations. Therefore, what is interesting, is that whether this co-development occurs or not, or rather to what extent it occurs. Based on the interviews conducted in this report, the perception of this has been identified as differing between the procurers and the suppliers, yet at the same time there has to be a procurer and a supplier in order to have co-development by obvious means. Based on the interviews of public procurers as presented in section 4.1, not only did the public procurers tend to answer that they did not develop solutions together with suppliers, most of them were not even aware that they could. Even more intriguing is that some even stated that it went against the principles of public procurement as it would potentially give an unfair advantage for one or more supplier, and that it was the fault of the "system" of public procurement. As a result of this, it seems to be a gap between the knowledge of public procurers and what is stated in the LOU. This knowledge gap may therefore inhibit the development of innovative solutions.

Even though some were aware that they could develop solutions together with a supplier, and some actually did, the interest of doing so seems to be relatively low. Surprisingly, some even stated that they did not want this type of communication or extend their current way of communication since it was perceived to implicate more work and increased complexity. This shows that the problem is not only lack of knowledge, which could be solved by informing public procurers what they are allowed to do, but also a matter of a way of thinking and the perception of complexity, which is

harder to change. Also, what is interesting and what has come up during the interviews is a matter of incentives. Even if a public procurer is aware of the fact that they actually can co-develop solutions together with a supplier, and convinced that it is not that complicated (yet require some kind of effort, which is unavoidable), why would they do so? If there is no obvious and direct benefit of doing it, by rationality they will not. The respondent which stated that they had developed a solution together with a supplier in the case of resonance problem with the Ullevi stadium, simply had to do it because their need was unique and there was no solution to it readily available in the market. The degree of involvement from the public procurer can be questioned though.

On the other hand, from the suppliers' point of view, the proportion of respondent in the interviews with supplier which state that they have been developing solutions together with a public procurer is higher, and even more of them stated that they have been developing solutions together with other customers (i.e. not public procurers). It is, however, interesting to look into what type of development that was in fact conducted. When confronted with this question, it turns out that only one supplier had developed a new product that they did not have before, and the rest of them had in various ways used modularity to combine already existing products into an overall solution which was unique for every customer or that the existing products were adapted to fit into the customer's facilities. The supplier that did develop a new product did actually only develop a product with the same properties and characteristics as previous products, but a different size. What is clear from this, is that what suppliers call innovation and new product development is different from the definitions used in this report. The implications of this fact will be discussed in the following chapter.

As mentioned earlier in this chapter, the degree of involvement in the cases of co-development mentioned in this report is interesting to look at. If a supplier has to do all of the work, with minimal supervision and intervention by the public procurer, is this still co-development? With the definition of innovation used in this report, they are at least not cases of co-development of *innovation*. It is furthermore questionable if they are examples of co-development at all.

In contrast to what have been said above, there is evidence that procurers can in fact make suppliers develop new and innovative solutions as was presented in section 4.4.

Although the cases from The Swedish Energy Agency were not cases of *public* procurement, they still proves the important point; that a demand for products that exceeds the performance of existing products can make suppliers to develop such products. The associated requirement specifications that were used in these cases helped and guided the suppliers by giving them a direction of search so that they knew that there would be a demand and what the expected performances was. This reduces some of the uncertainties associated with developing new products.

6 - Discussion

In this section, the findings of the analysis in the previous section will be discussed. Additionally, interesting ideas and aspects that have emerged from the analysis and also those not directly supported by the data collected in this report, will be discussed.

One fact that has been realized during the research work behind this thesis is that the concept of lead users; their characteristics and criteria, was more developed to fit the industry and product development, whereas public procurers are somewhat different from industry in terms of both their goals and their processes. Regarding the goals, public procurers typically try to reduce cost, whereas the industry seeks for profit. The procurement process also looks different as the public procurers have more strict constraints on how they can collaborate with suppliers, something that the industry does not have. Yet, the principle of having needs ahead of the market and to be able to supply usage data and functional requirement specifications is shared between the two types of actors.

As was concluded in the previous section, public procurer are not acting as lead users. It seems like they are not aware of the fact that they have a potential role to promote innovation, and that they are part of the innovation system. In this report, the relationship between public procurers and suppliers of innovation was studied. However, it was found that this was only a part of the entire innovation system, and that there seem to be one more actor originally not thought of, that potentially is influencing the behavior of the public procurers. The identified actor is operating at a higher level; at the level of the entire society. This actor is the government, or more precise the policies and guidelines developed and presented by them. As was found, the main obstacle for public procurers to be promoters of innovation is not different perceptions of them and the suppliers of innovation. Rather, that they do not perceive their role to be one of promoting innovation but to procure products available on the market at the lowest possible price. Exactly how strong this influence is can be hard to estimate. One issue concerns how public procurement of innovation can promote supplier innovations, whereas a second issue concerns how policies may facilitate and/or avert public procurement of innovation.

As has been stated in the literature section, early adopters are more forgiving and accept some malfunction and bugs in prototypes. In some cases, such as the healthcare industry, having malfunctions is not so good. Although, based on the case presented in section 4.4, it was possible to work with prototypes anyway, which supports the thought that it would be possible in other industries and areas as well. One of these is green innovation, as it is an area where long-term effects are very important and short-term benefits are relatively low. Thus, promoting innovations in this field is important for the society and should be backed up by the government through policies.

As has been identified, public procurers are not at the frontier of procuring innovative solutions. It was introduced in section 1.1 that; innovations have laid the foundation of what we see in our society today, an important source of economic wealth which has great importance for the development of the society, in terms of technology and culture at large. This statement does, however, not state in which ways and by whom these innovations are created and diffused. In a market based economy with a supply and demand, it could be argued that innovations that improves on existing products and services, or even radically new innovations, are created to an extent that is economically viable, based on the cost of developing and producing by the supply side, and the willingness to pay from the demand side. However, certain types of innovation which are characterized by high costs (economical, cultural etc.) initially, whereas the benefits are only visible in the long-term and perhaps also a risk of there not being a benefit at all. In these cases, the society needs to step in. In market based economy, it could thus be cases where the market fails to develop innovations that is for the interest of the society in the long run, as sub optimizations and short-term interests are perceived to be more profitable. This can be seen as a failure for the society in the long term. Even in cases where the need to innovate and in what direction, is evident; the current development does not seem to be enough. This reasoning is particularly evident when looking at green innovations.

Currently, the resource consumption of the world's population is greater than what the earth produces. This is made possible by using resources created previously and stored in various ways (e.g. fossil fuels). Draining more resources than produced is possible for a limited period of time, but not sustainable in the long run. Therefore, business as usual in terms of resource consumption will eventually fail, which would in turn have an

immense impact on the society at large. This is not, however, to say that this market failure is the fault of only business as usual by public procurers. However, as was previously presented in section 2.4, public procurement is *one* way for the society through policies to promote innovation, possibly even to direct innovation in a certain direction (e.g. to more energy efficient solutions). After all, it is for the best of the society in the long run. One other way to see this is that, since doing nothing or little when it comes to green innovation is guaranteed to fail, trying to stimulate long-term green innovations is at least to avoid guaranteed failure.

Building on what was said above, short-term cost-oriented performance measurements on public procurers could negatively impact the promotion and diffusion of innovations as mentioned in the previous paragraph. The same reasoning can also be extended to the level of the society. There, politicians usually stay in power for a certain predetermined period after which they might be allowed to continue at power based on the results of voting of the population. In the case of Sweden, which is the area of focus in this report, this period is four years. The voting by the population of which party or parties to be in power is affected by a large set of aspects, included but not limited to; prior performance (or *perceived* such performance), and expectations of future performance. This performance could in turn be based on factors such as employment rate and general welfare. Regardless of exactly how the performance is measured and the definition of welfare (which is most likely to differ between individuals anyways), it is still a measure, which is based on a certain time period just like with the measurement of the performance of public procurers. Therefore, just like with the public procurers, short-term interests are likely to influence the decision makers. Consequently, the process of developing incentive structures and overall policies to be innovation friendly or promoting innovation is a delicate one. This is particularly difficult since the benefits, on a societal level, by having more innovative solutions, are most likely (if at all) to be visible in the long-term whereas the cost of developing and diffusing them appears immediately. However, if nothing or little is done, the level of welfare is likely to decrease in comparison to other societies or nations.

Another fact that potentially is explaining public procurers reluctance of searching for innovations could be the principle of subsidiarity. As has been learnt through interviewing the public procurers, there is often a specific subdivision of the

organization that is responsible for the procurement, and they are *not* the ones that in the end will be using the procured products. In fact, the end users or consumers are more likely to see the need, benefiting from a solution and also to innovate (Lüthje, 2004). Furthermore, as the procurement department have pressure from the organization directly, and the government indirectly, to procure the needed products as cheap as possible to save the taxpayers' money, they will have an incentive to do just that. Paying a slightly higher price and taking a somewhat higher risk, in order to procure a more innovative product, will lead to worse performance in terms of how the procurement department are measured and they will therefore tend not to do so. This is even true in the case that procurement of more innovative products can be economically motivated in the long run, as decision makers are likely to be measured with shorter time horizon than what in business terms is called payback period. As even more distance is put between the procurer and the end user, as in for example the healthcare area, where the user of the product (or service), the patients, are not even part of the procuring organization at all. To overcome these hurdles, policy at higher levels, perhaps even at societal level, is most likely to be needed. The case of the healthcare industry in United Kingdom, presented in section 4.5, proves that is in fact possible for a nation, by changing incentive structures and objectives of existing organizations and authorities, as well as creating new ones, to promote innovation in an industry that with the above mentioned logic would be a difficult one. This indicates that it, at least in theory, should be possible to promote innovations in other areas as well by creating the right conditions. Another initiative that further strengthens this view is the case of the Swedish Energy Agency and their technical procurements that were described in section 4.4. Again, a set of actions made by a governmentally controlled agency enabled both development and diffusion of innovative solutions, which also in some cases resulted in propagation of technology throughout the entire industry.

It lies in the interest of SP to understand, and create a checklist for public procurers of how to be more innovation friendly. One of the cornerstones for this wanted behavior has ruled to be the use of functional rather than precise technical specifications in the requirements specifications created by the public procurer in the process of public procurement, based on both the literature surveyed in chapter two of this report, by the examples of innovation friendly procurements presented in chapter four, and also by logical reasoning.

One of the principles of public procurement, which was stated in section 2.3.2, is the principle of equal treatment. All suppliers should have an equal chance and cannot be subject to selection bias by the public procurer. The idea behind this principle is great, and in theory this would allow even new and radically different innovations to compete with older technologies. However, in practice, new solutions could effectively be excluded anyway as a result of public procurers' requirement specifications if they are too tight specified and in technical terms rather than functional terms. One concrete example of a policy, which had good intentions, was to increase the development and diffusion of alternative fuels in Sweden. The policy was that each gas station should supply at least one type of alternative fuel. Since the policy did not state which type of alternative fuel, it was believed to be neutral and open up for various kinds of fuels. However, it backfired and basically all gas stations selected ethanol since it could be served through their existing tanks and pumps and was thus much cheaper to introduce compared to for example electricity and natural gas which both requires investment in new equipment. Both these policies sounds good in theory, but could in practice lead to results different from what was originally thought of. Stating policies that are truly innovation friendly and not biased towards a specific type of innovation is difficult.

Another aspect and characteristic of a product that also was not originally known and sought for in this report is modularity. A supplier whose solutions are unique, and thus always new, can be generated simply by combining a set of existing products in a configuration that is new and have useful and commercially viable applications. Another possibility that shares this principle, is when an existing system simply by doing a small local adjustment or adaptation, also creating a new and useful product. In this report, they are considered as incremental innovations as they are "same but different" or "same but better". However, a possible confusion made by both public procurers and suppliers of innovation can be seen in this matter, and a precise classification whether an innovation is incremental or discontinuous, if it is an innovation at all, can be distinguished. Furthermore, if these types of innovation is to be classified as a co-development of innovation or not is also a matter of debate. One aspect that was found during the interviews with public procurers, and later on analyzed in section 5.2.1, is that the public procurers perceive functional requirement specifications more complex – although it should be simpler. However, it can be

discussed if it in reality simply postpones the complexity to the later stages of the procurement where a winner is selected. Having a more innovation friendly requirement specification, one could potentially end up with many more solutions than if the requirements would have been more specific. Having a larger count (and more different) of solutions would make the decision of which one to pick more difficult.

As has been contended throughout this report, the "demand-side" is of great importance for the development of innovations and economic growth of the society. Thus, aligning the interests of suppliers, public procurers but also the interests of the society, to make public procurers more interested in promoting innovation is important. However, how this can be achieved is a topic of its own and needs further investigation, which is also mentioned in chapter eight.

In hindsight, we realize that the selection, in particular the public procurers, is subject to a selection bias and that the comparison between the interviewed public procurers and the case of the United Kingdom healthcare system could be seen as an unjust comparison. The nature of different types of public procurers can be categorized into those which are more administrative and paperwork type of operations where business as usual is likely to be found, and one in which the business will have direct impact for the life of people (such as the healthcare and military). In the latter case, the level of urgency is high and development of new solutions are more likely, whereas in the first case the level of urgency is quite low and doing business as usual does not create an imminent threat. Based on this, the findings of this report are in line with what they were expected to be. Yet, it serves a purpose for, among others, SP and the Ecopol project, as it is a proof of the existing of a widespread business as usual behavior. By showing that this type of behavior is common, and provide a base for further research within the field, it is a first step towards mitigating the issue. Also, the business as usual segment is much more relevant to SP and the Ecopol project as it is there their focus of green public procurement lies, at least more so than for example military and healthcare industries.

One aspect that is novel with this research is the introduction of the lead user perspective and user involvement in relation to public procurement. It has given new insights that were not previously known to SP.

7 - Conclusions

In this chapter, we conclude the findings of both the analysis and the discussion section. The purpose is to help the reader of this report to understand the key findings of the research conducted. Firstly, the role of public procurers as customers will be addressed, and secondly the role of public procurers from a wider innovation system perspective will be addressed.

In this report, the role of public procurers as customers and promoters of innovation has been divided into two dimensions. Firstly, by using the definition of customer types developed by Rogers (1962), where possible types ranges from innovators, early adopters, early majority, late majority and finally laggards. Secondly, public procurers as potential lead users have also been looked at.

The public procurers were classified to be between early majority and late majority since they had the main characteristics of both these customer types, as illustrated in *Figure 8*. Even though public agencies could think of purchasing products (and services) being in its early phases, due to the fact that the product had to meet the very specific technical requirements it mostly turned out to be the products in more mature industries with incremental changes that were adopted. This behavior signifies that public procurers do not have high influence on the development of (radical) innovation and the diffusion of it at the moment. The role they do have is, based on that they are characterized to be between early majority and late majority, that they increase the sales of incremental innovations or products that already exists. This boost in sales volume can create a competitive advantage for the companies and does in some cases lead to incremental innovations (e.g. energy efficiency), but innovations of a more radical nature are rarely seen.

Public procurers clearly have the potential to move into the early phases of the development cycle of the innovation to help innovations crossing the chasm, as they don't mind being among the first to adopt. However, since it is a matter of spending tax money; public procurers, in line with the current legislation, goes for the cheapest suggested bids. Consequently, this often turns out to be the product (or service) that meets the specified requirements but without additional features. In other words, the "simplest" product (or service) that is suggested. This indicates that public procurers

will not become an early adopter if they don't have incentives to do so, which takes us to the conclusion that, for public procurement to become a successful tool as a promoter of innovation, it needs back-up from policymakers.

As was mentioned in the last part of the discussion, the type of public procurers that were interviewed in this study can be considered to belong to a "business as usual"-segment. Another segment of public procurers which is the healthcare and military, which is signified by a higher level of urgency in their development and are more likely to be more of early adopters compared to the first segment.

Having addressed the position of public procurers in Rogers (1962) model, from a lead user dimension, the majority of public procurers do not fulfill the criteria of being lead users. These criteria were explained more in detail in chapter 2.5.1. In one case which was studied in this report, the healthcare industry in United Kingdom, clearly had one of the criterion; a strong present need that will become general in a market place months or years in the future. However, it is not clear whether they fulfilled the second criterion of providing new product concepts and design data. Furthermore, the criterion of expecting to benefit significantly by obtaining solutions to their need, can be questioned. The ones that benefit the most are in this case the patients, which are not part of the procuring organization at all.

Several cases from the Swedish Energy Agency were investigated in this report. Many of these cases resulted in products that had significant performance improvements compared to what was on the market at the time and which at least in one case transformed the entire industry. However, the Swedish Energy Agency was not the procurer, but provided expertise in developing the requirement specifications, which was later on used by the suppliers in their development. The end users was though benefiting significantly from the innovation. Thus, it is obvious that procurer in general can have characteristics of lead users and any reasons for this not to be possible for public procurers have not been found.

Looking at public procurers position and role from a wider innovation system perspective, it is visible that, in order to have successful innovation, both the public procurers and the suppliers must work in tandem. However, what has been identified is

that the public procurers do not see themselves as having the role as promoters of innovation. Therefore, in order to have an innovation system in which the public procurers act as customers and promoters of innovation, incentive systems must be put in place in order to motivate the public procurers.

One important factor when creating requirement specifications that are innovation friendly has been found to be the use of functional requirements. It is a method that is well recognized among different public agencies. On the other hand, the actual usage of this method as a way to place an order of something that does not yet exist, is something that the public procurers believed to be rather more complex than it actually is. Placing an order where a function or performance is asked for, instead of specifying the technology, should in practice be a lot easier as it does not require any knowledge in that field. Furthermore, using functional requirement specifications is one step towards moving from early and late majority to the early adopter customer type. This, in turn, opens up new possibilities of becoming lead users.

As the public procurement process is very regulated, a need to communicate outside this regulated process is sometimes warranted. Seen from the public procurer, the awareness of the possibilities of communicating outside the public procurement process is low. Some even thought it was strictly illegal and was against the principles of public procurement. The communication outside the public procurement process enables promoting of innovation, by early on inform the suppliers and market their intentions and ensuring there is a market for new and innovative solutions. If the awareness was concluded to be low, the use of it was even lower. The public procurers lacked an understanding of why they should perform this communication and saw this as something that is both complex and involves extra work, something that would not benefit them at all.

Seen from the suppliers' point of view, the interest of receiving information related to both current and future needs (both from public procurers and other customers) was high. Exactly how the arrangement of receiving such information from public procurers was however a tougher question. Ideally, the suppliers would like to receive such information directly sent to them, as surveying all possible procurers for their need would require more resources than the supplier can handle. At the same time, the public

procurers cannot simply inform all possible suppliers for every need they have. To summarize; the use of communication outside the procurement process is low. Although the suppliers would like to have such information, the public procurers see this as added work. The same reasoning goes for co-development of solutions; where the suppliers are generally more interested compared to the public procurers. The suppliers sees it as a way to improve their current assortment and therefore benefit from the co-development even at later points in time after the (possible) procurement has been made. Important to note, though, is that co-development with a public procurer does not automatically mean that the supplier will win in the actual procurement as it is against the principles stated in the LOU.

Most of the public procurers said that they did not co-develop solutions. Some did not even know that they could, which indicate there is a knowledge-gap between what the LOU states and what is known by the public procurers. Solving this knowledge-gap, perhaps by education, is however not enough; as other interests, such as low price, is favored by the public procurers and they lack incentives to be innovation friendly and to co-develop solutions with the suppliers. Furthermore, co-development of solutions together with suppliers is generally perceived as added work for the public procurer, which further strengthens the point that education is important.

The results of this study were somewhat expected, but SP and the Ecopol project needed confirmation on the subject and also in need to identify new areas of interests which could be used to research further. The introduction of lead users perspective is one of those areas, and can be useful in the study of public procurement.

* * *

To summarize, the procurers themselves should not be considered as promoters of innovation, but rather as a tool that can be controlled by policy (at national or even EU level) that provides a market for new and innovative products.

The big problem is not that public procurers lack the basic understanding of public procurement and functional requirement specifications. Although this knowledge is a prerequisite, it is only effective when it is in use. As the use of functional requirement

specification is low and the procurers generally do not see that their role is to promote innovation, policy should create incentives in a way that makes the procurers *want* to promote innovation, why should they otherwise?

We recommend government and policy makers to carefully study both the case of the United Kingdom healthcare industry which included innovation and prototype-testing as a direct consequence of policy, as well as the methods used by the Swedish Energy Agency to learn the important procedures which enabled promotion of innovation, and project this into creating policies for public procurers which gives incentives and guidelines to promote innovation.

All comes down to the importance of aligning the interests of suppliers, procurers and the society which are all part of the innovation system.

8 - Further research

As with most research work, new issues or interesting areas of investigation that is outside of the scope of the current work arises. The work behind this report is not an exception, and in this section some interesting areas of future investigation will be presented. These areas are related to 1) the generalizability of the findings, 2) the incentive system and interests for public procurers to promote innovation, and 3) legal considerations.

The focus of this report has been to get an understanding of whether public procurers and suppliers of innovative solutions are aware of public procurers potential role as promoters of innovation. However, although the general framework of public procurement is shared within the European Union, each nation formulates its own laws and regulations. It would therefore be interesting for further research to investigate whether the findings of this report can be generalized to be valid even outside the boundaries of Sweden.

What was discovered during the research work of this report is that the incentive system for public procurer could be an important factor when it comes to promoting innovation. Due to the nature of this research, it is not possible to simply test one incentive system or the other and see what happens, as it involves changing the entire way of working for public procurers. There is also the fact that there will be no control group even if such a trial were to be conducted, and rivalry explanations of a contingent difference would most likely exist. It would, though, be interesting to investigate this further perhaps by comparing (possibly different) national systems to be able to discern characteristics that are not only innovation friendly, but also innovation promoting.

As was identified in this report, incentives for public procurers to promote innovation is of great importance and act as a prerequisite. However, how this incentive structure should be constructed is a difficult question and has been out of scope of this study. Researching on this subject further; perhaps by drawing on cases of different cases of regulation and policies in the past, and compare their outcome, would be one potential way to do this. Other solutions that can also been subject to further research is letting the market decide what to do, perhaps using guidance such as penalty taxes on unwanted behavior or on resource consumption so that the full cost for the society in the

long-term is depicted in the price of the good. This would at least in theory lead to development of more sustainable solutions.

Another legal aspect of public procurement and the lead user perspective has been discovered. To what degree are public procurers allowed to collaborate and co-develop solutions together with suppliers? Are they allowed to finance (at least partly) this development? Making the answer of these questions clear, perhaps by giving concrete examples of what is allowed, preferred and what is not, and transfer this knowledge to the public procurers, would reduce their uncertainties and guide them into becoming more innovation friendly.

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Appendix 1 – Interview guide used for procurers

Hej!

Jag heter <name> och är student på Chalmers. Vi skriver ett arbete om offentlig upphandling och innovation och undrar om det finns någon hos er som vet hur era upphandlingar går till och som vi skulle kunna ställa ett par frågor till?

Innovationer är definierat som någonting nytt, något som inte har funnits tidigare - officiellt. Detta inkluderar även innovationer i form av befintliga föremål eller processer som används på ett nytt sätt eller i nya kombinationer. Vi vill härmed understryka att vi i denna undersökning enbart kommer att fokusera på diskontinuerliga innovationer, vilket innebär att "mönstret"/"banan" från det förflutna bryts för att skapa nya radikala tekniker och processer. Därmed tillåter diskontinuerliga eller "banbrytande" innovationer nya industrier och marknader att växa fram, omvandlas eller försvinna.

1----------

(Som en del i anbudsförfarandet i en offentlig upphandling ingår att en kravspecifikation behöver tas fram)

En kravspecifikation kan vara skriven på flera sätt, exempelvis genom att referera till olika former av standards, detaljerade tekniska specifikationer och så vidare. Lagen om offentlig upphandling tillåter även något som kallas funktionell beskrivning eller mer allmänt funktionell upphandling. Är det något ni vet vad det är eller känner till?

Om det är något de känner till: Är det något som ni tänker på och använder er av i era upphandlingar?

Har du möjlighet att uppskatta i vilken utsträckning ni använder er av funktionella kravspecifikationer

Om nej: Ett exempel på funktionell upphandling är t.ex. att man upphandlar ljus för motorvägen, snarare än specificerar exakt vilken typ av lampa / stolpe man letar efter och på så sätt låser man inte in sig till befintliga lösningar. (kontrollera att de förstod efter beskrivning)

2----------

Det kan finnas en tendens att rena tekniska kravspecifikationer och referenser till etablerade standards har en tendens att gynna större och etablerade aktörer på marknaden, medan mindre entreprenöriella företag med helt nya produkter som ännu

inte hunnit täckas av en standard och som skiljer sig markant mot de produkter som upphandlats tidigare missgynnas. Är detta något som ni är medvetna om och/eller tar hänsyn till i er upphandling?

Om ja; Håller de med? Kan ni ge exempel på någon sådan upphandling?

3----------

De två grundprinciperna när valet av leverantör ska göras är att antingen välja den leverantör som erbjuder det ekonomiskt mest fördelaktiga anbudet, eller helt enkelt den som kan leverera enligt kravspecifikationen billigast. I förfrågningsunderlaget kan det även ställas krav på hållbar utveckling, såsom sociala hänsyn och miljöhänsyn.

Är det något som ni gör?

I vilken utsträckning?

Något exempel?

4----------

Har ni på något sätt varit delaktiga i utvecklingen av innovationer, alltså att ni varit med och utvecklat något som ni senare upphandlat? Eller har ni helt enkelt tagit det som redan finns ute på marknaden?

Om nej: Är de medvetna om att de enligt lagen får utveckla produkter tillsammans med en specifik leverantör? (bara alla får tävla för att senare få kontraktet i upphandlingsfasen)

Om ja: något exempel?

5----------

Undersöker ni vad marknaden har att erbjuda i samband med en upphandling?

Om ja: Hur går ni tillväga?

Finns det någon risk att nya och mindre företags produkter väljs bort i ett tidigt stadium?

Hur hittar ni de olika aktörerna på marknaden?

På vilket sätt skulle ni önska att ni får kontakt med nya företag med nya innovativa lösningar?

6----------

Kommunicerar ni med marknaden andra sätt utöver det som sker i upphandlingsprocessen?

Något exempel?

Exempelvis: “Om 3 år kommer vi att efterfråga XYZ”

Appendix 2 - Interview guide used for suppliers

Hej!

Jag heter <name> och är student på Chalmers. Vi skriver ett arbete om offentlig upphandling och innovation och undrar om det finns någon hos er som vet hur era upphandlingar går till och som vi skulle kunna ställa ett par frågor till?

1. Har ni någon gång varit med och givit anbud i en offentlig upphandling?
- Om ja, något exempel?

2. Var produkten ni försökte sälja utvecklad tillsammans med upphandlaren?
- Om ja, något exempel?
- Om nej, gå till #3

3. Vet ni om att det är tillåtet att utveckla en produkt tillsammans med en offentlig upphandlare (rent juridiskt), sålänge själva upphandlingsprocessen senare följs enligt gällande regler där alla tävlar på lika villkor?
- Hur ser era tankar ut när det gäller detta?

4. Har ni i andra (icke publika) upphandlingar utvecklat en produkt tillsammans med köparen?
- Om ja, något exempel?

5. Skulle ni kunna tänka er att utveckla en lösning tillsammans med en offentlig upphandlare, även om ni inte är garanterade att bli valda som leverantör under upphandlingsprocessen?

6. Har ni kommunicerat med, exempelvis tagit del av information ifrån offentliga upphandlare utanför upphandlingsprocessen (exempelvis genom dialog, konferenser etc), och utvecklat en produkt därefter?
- Om ja, något exempel?

7. På vilket sätt skulle ni som leverantörer vilja bli informerade om offentliga upphandlares behov? (Vissa har egna hemsidor där de visar information, andra har

konferanser, andra informerar bara indirekt med sina kravspecifikationer vid upphandlingar)

8. Skulle det påverka, i så fall på vilket sätt, om ni som leverantör fick en ersättning exempelvis genom en schablonsumma, för att ge anbud i en offentlig upphandling då det kostar att arbeta ihop ett anbud?
- Skulle det få er att vilja delta i (fler) offentliga upphandlingar?
- Kommer ni på något annat

9. Vågar ni ställa upp med anbud innehållandes innovativa produkter, då dessa blir offentlig handling kan det bli lätt att någon annan kan sno ens idé och vid nästa upphandling erbjuda liknande saker, kanske till lägre pris?

10. Är det intressant för er om anbuden blir utvärderade efter t.ex. lägsta livscykelkostnad snarare än det lägsta "up-front" kostnaden?

Appendix 3 - Conversion from alias to corresponding public procurers and suppliers

This information will be given to SP only, thus not available in this public report.